COMPUTING FOR BUSINESS AND HOME

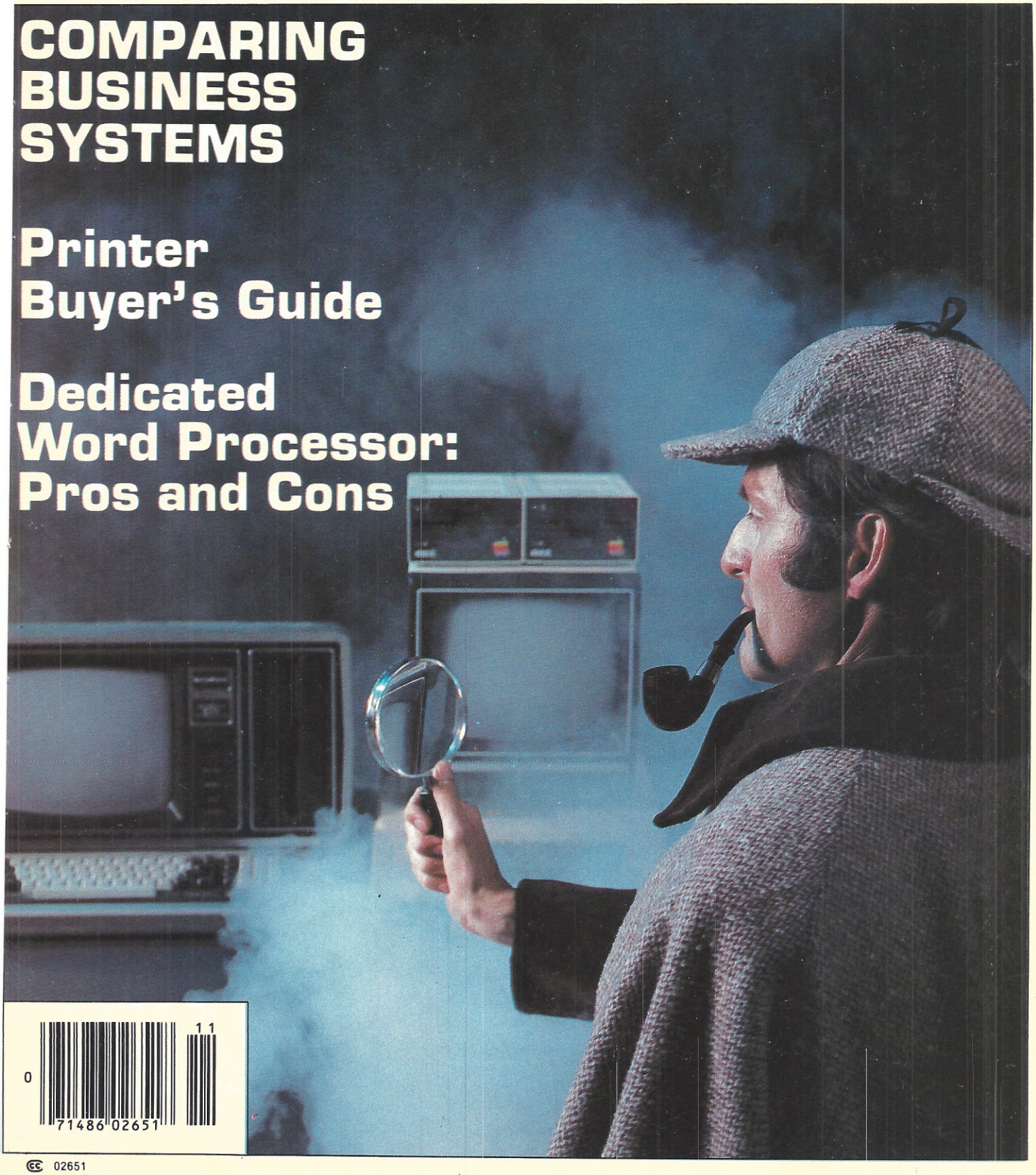
INTERFACE AGE™

NOVEMBER 1981 $2.50/CANADA/MEXICO $3.00

COMPARING BUSINESS SYSTEMS

Printer Buyer's Guide

Dedicated Word Processor: Pros and Cons



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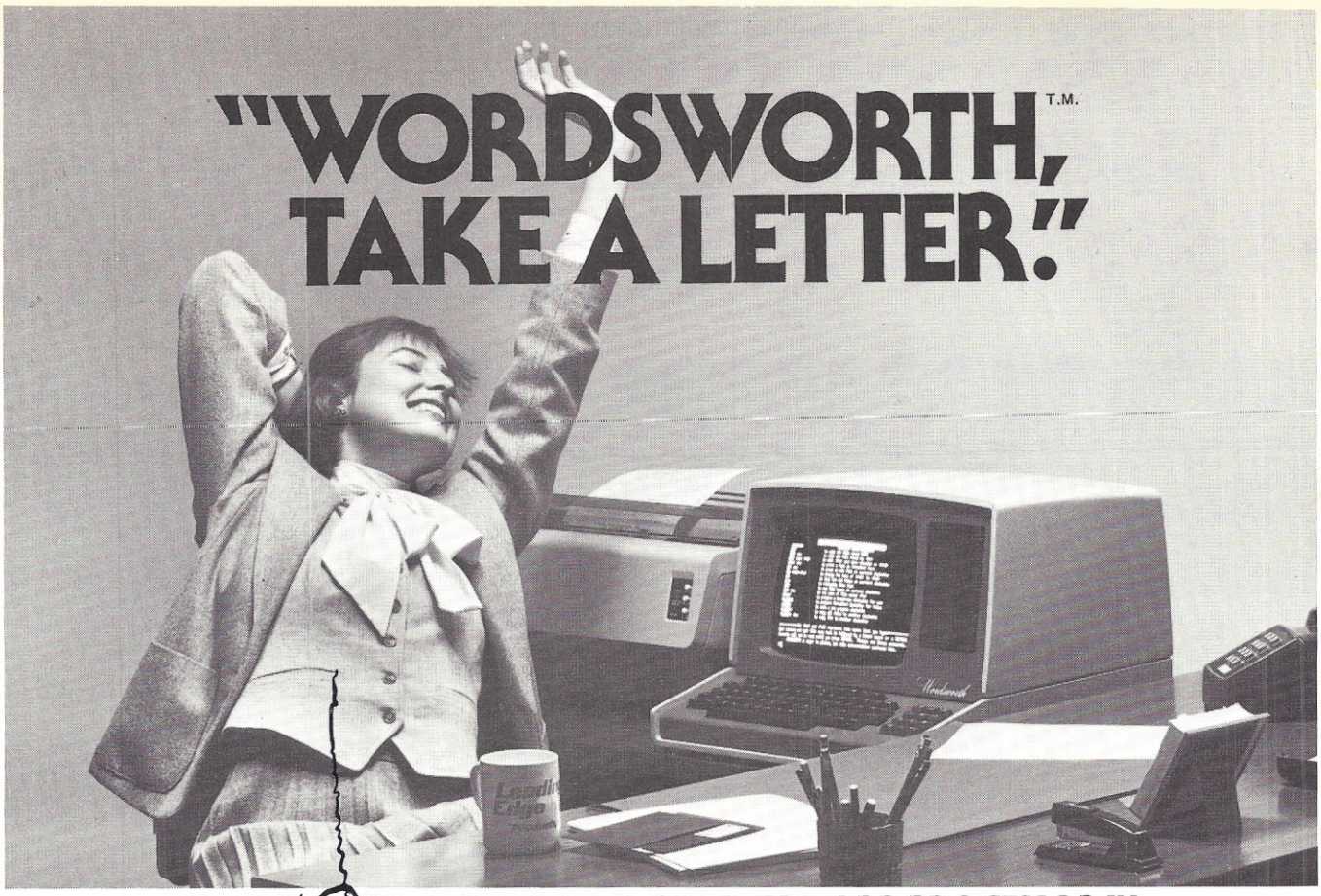

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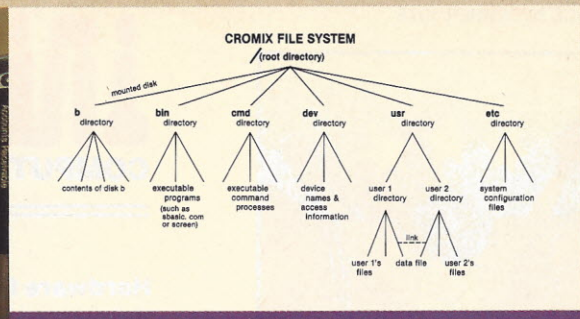

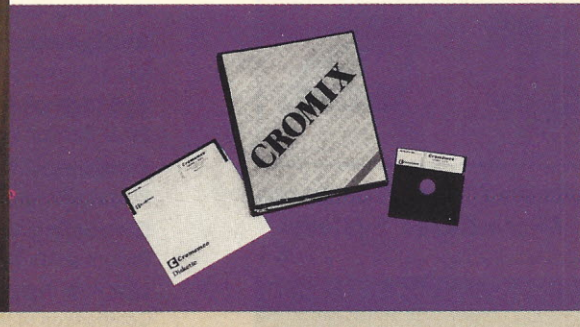

CROMIX*— Cromemco's outstanding UNIX†–like operating system

CROMIX is just the kind of major development you've come to expect from Cromemco. After all, we're already well-known for the most respected software in the microcomputer field.

And now we've come up with the industry's first UNIX-lookalike for microcomputers. It's a tried and proven operating system. It's available on both 5'' and 8'' diskettes for Cromemco systems with 128K or more of memory.

Here are just some of the features you get in this powerful Cromemco system:

- Multi-user and multi-tasking capability
- Hierarchical directories
- Completely compatible file, device, and interprocess I/O
- Extensive subsystem support

FILE SYSTEM

One of the important features of our CROMIX is its file system comprised of hierarchical directories. It's a tree structure of three types of files: data files, directories, and device files. File, device, and interprocess I/O are compatible among these file types (input and output may be redirected interchangeably from and to any source or destination).

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PROTECTED FILES

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TREMENDOUS ADDRESS SPACE, FAST ACCESS

The flexible file system and generalized disk structure of CROMIX give a disk address space in excess of one gigabyte per volume — file size is limited only by available disk capacity.

Speed of access to disk files has also been optimized. Average access speeds far surpass any yet implemented on microcomputers.

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Cromemco offers a wide range of languages that operate under CROMIX. These include a high-level command process language and extensive subsystem support such as COBOL, FORTRAN IV, RATFOR, LISP, and 32K and 16K BASICs.

There is even our highly-acclaimed 'C' compiler which allows a programmer fingertip access to CROMIX system calls.

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The power and breadth of its features make CROMIX the standard for the next generation of microcomputer operating systems.

And yet it is available for a surprisingly low $595.

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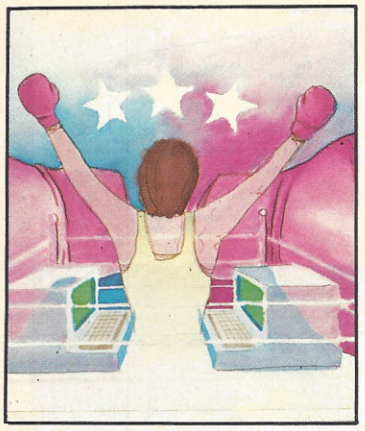
INTERFACE AGE™

COMPUTING FOR BUSINESS AND HOME APPLICATIONS



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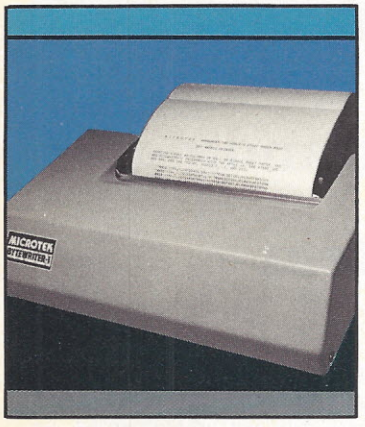

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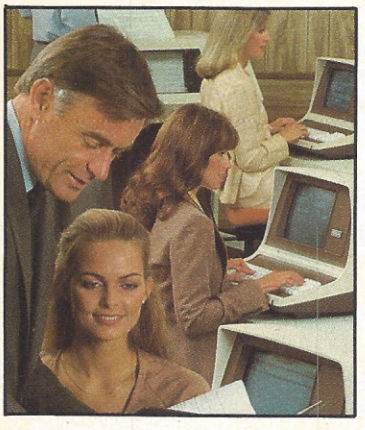

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Cover photography by Mara Model: Colin Cato

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COLUMNS

DEPARTMENTS

Contact authors of monthly columns by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701 in care of their respective columns.

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Daily Tribune

40 EDITION ★★★★ FORECAST: HOT

RETURNS ARE IN; CPAIDS VOTED MVP

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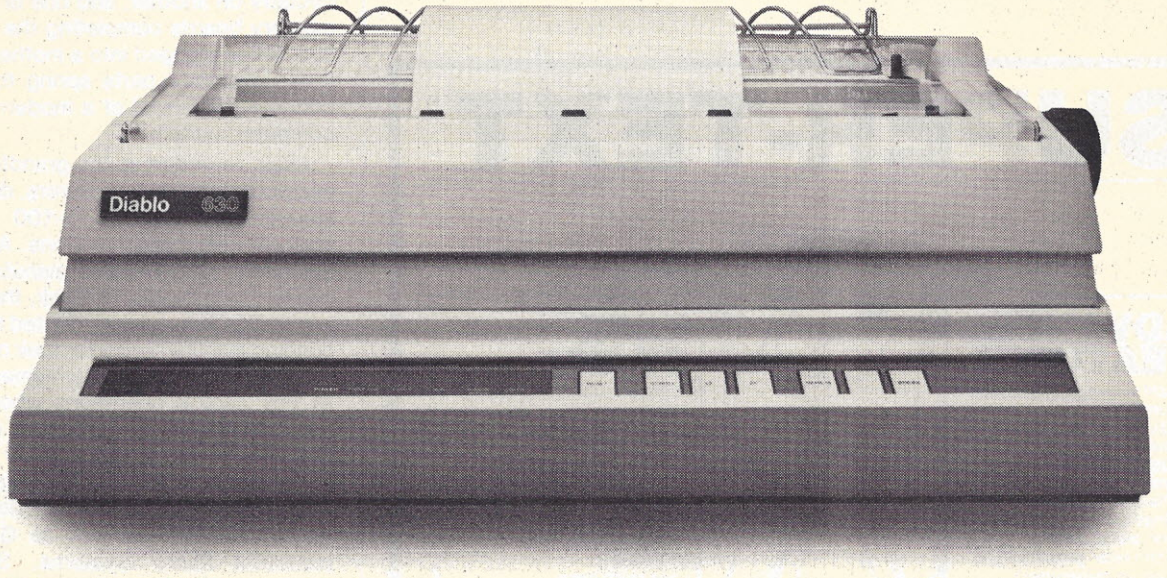
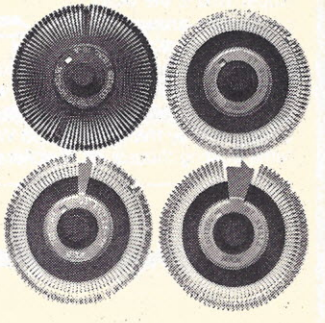


The Diablo 630.

It's the first printer that lets you use either metal or plastic print wheels. So you can choose the print wheel that's just right for the job.

The 630 works as well with a 96-character plastic daisy print wheel as it does with an 88-, 92-, or 96-character metal daisy print wheel. In over 100 different type styles.

Every 630 has fewer moving parts than competitive printers, which makes it more reliable. And it offers unsurpassed print quality. Compatibility with Diablo supplies. And bi-directional printing capability.



So if you want to change your print wheels, you'll just have to change your printer.

To a Diablo 630 printer.

Diablo Systems

XEROX

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EDITOR'S NOTEBOOK

Catching up with busses

What are *busses*, and why are they important to computer buyers? We hear about the S-100 bus, SS-50 bus, Multibus...even the "software bus." What's this all about?

The computer term bus (sometimes spelled "buss" in an attempt to distinguish it from the four-wheeled omnibus) is borrowed from the electrical industry. In that context, a *bus bar* is a solid bar of metal that transports electrical current from where it is generated to where it is needed.

Similar in concept, a computer bus is a means to distribute electrical signals from place to place within a computer. Electrical current for power is sent about in this manner, as well as the delicate data and timing signals that rattle back and forth at rates counted in the millions per second.

The physical implementation of a bus usually begins with a *mother board*, an etched circuit board consisting of little more than a set of multi-pin connectors —themselves interconnected by conducting traces of copper on the mother board itself.

The connectors on the mother board are designed to accept the edges of other circuit boards termed *daughter boards*. It is these boards that contain a computer's central processing unit (CPU), memory, input/output (I/O) and other necessary circuitry. The functions are usually physically separated, with the CPU being on one board, the I/O circuitry on another, and one or several memory boards completing the population. When plugged into a mother board, these disparate parts spring to life to become the kernel of a modern microcomputer system.

Altair, regarded as the grandfather of microcomputer manufacturers, designed something called the S-100 bus to perform just these functions. Although designed simply as a manufacturing convenience by and for Altair, the S-100 bus design was quickly adopted by other budding manufacturers for their own use.

Many of today's familiar names began as tiny garage operations whose sole purpose was to make add-on memory boards for Altair and other S-100 computers. Such were the beginnings of Imsai, Processor Technology and Vector Graphic; as well as Godbout, Industrial Micro Systems, Systems Group and TEI in more recent times. The result is that the owner of an S-100 bus computer currently has a wide choice of boards that can be purchased from a growing list of vendors to enhance his system. The recent standardization of the S-100 bus by the Institute of Electrical and Electronics Engineers (IEEE) has validated the concept of interchangeable S-100 boards, much to the benefit of all concerned. (However, not all S-100 products being sold are built in conformance to the IEEE standard.)

This interchangeability has been very healthy for the growth and acceptance of microcomputers. It was directly responsible for the existence of many of the computer manufacturers listed above, and others as well. It also serves to calm a buyer's fears that he might be purchasing a one-of-a-kind special from an unknown computer maker. Many operators of Imsai computers (now defunct as a manufacturer) are perking along happily with parts, carrying a half-dozen different manufacturers' boards nestled comfortably in their S-100 busses.

Interchangeability is the concept that generated the remarkable fabrication

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INTERTEC'S INCREDIBLE 255 USER SMALL BUSINESS COMPUTER

At last, there's a multi-user microcomputer system designed and built the way it should be. The CompuStar™. Our new, low-cost "shared-disk" multi-user system with mainframe performance.

Unlike any other system, our new CompuStar offers what we believe to be the most practical approach to almost any multi-user application. Data entry. Distributed processing. Small business. Scientific. Whatever! And never before has such powerful performance been available at such modest cost. Here's how we did it . . .

The system architecture of the CompuStar is based on four types of video display terminals, each of which can be connected into an auxiliary hard disk storage system. Up to 255 terminals can be connected into a single network! Each terminal (called a Video Processing Unit) contains its own microprocessor and 64K of dynamic RAM. The result? Lightning fast program execution! Even when all users are on-line performing different tasks! A special "multiplexor" in the CompuStar Disk Storage System ties all external users together to "share" the system's disk resources. So, no single user ever need wait on another. An exciting concept . . . with some awesome application possibilities!

CompuStar™ user stations can be configured in almost as many ways as you can imagine. The wide variety of terminals offered gives you the flexibility and versatility you've always wanted (but never had) in a multi-user system. The CompuStar Model 10 is a programmable, intelligent terminal with 64K of RAM. It's a real workhorse if your requirement is a data entry or inquiry/response application. And if your terminal needs are more sophisticated, select either the CompuStar Model 20, 30 or 40. Each can be used as either a stand-alone workstation or tied into a multi-user network. The Model 20 incorporates all of the features of the Model 10 with the addition of two, double-density mini-floppies built right in. And it boasts over 350,000 bytes of local, off-line user storage. The Model 30 also features a dual drive system but offers over 700,000 bytes of disk storage. And, the Model 40 boasts nearly 1½ million bytes of dual disk storage. But no matter which model you select, you'll enjoy unparalleled versatility in configuring your multi-user network.

Add as many terminals as you like - at prices starting at less than $2500. Now that's truly incredible!

No matter what your application, the CompuStar can handle it! Three disk storage options are available. A tabletop 10 megabyte 8" winchester-type drive complete with power supply and our special controller and multiplexor costs just $4995. Or, if your disk storage needs are more demanding, select either a 32 or 96 megabyte Control Data CMD drive with a 16 megabyte removable, top loading cartridge. Plus, there's no fuss in getting a CompuStar system up and running. Just plug in a Video Processing Unit and you're ready to go . . . with up to 254 more terminals in the network by simply connecting them together in a "daisy-chain" fashion. CompuStar's special parallel interface allows for system cable lengths of up to one mile . . . with data transfer rates of 1.6 million BPS!

Software costs are low, too. CompuStar's disk operating system is the industry standard CP/M*. With an impressive array of application software already available and several communication packages offered, the CompuStar can tackle even your most difficult programming tasks.

Compare for yourself. Of all the microcomputer-based multi-user systems available today, we know of only one which offers exactly what you need and should expect. Exceptional value and upward growth capability. The CompuStar™. A true price and performance leader!

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Baked Apple.

Last Thanksgiving, a designer from Lynn/Ohio Corporation took one of the company's Apple Personal Computers home for the holidays.

While he was out eating turkey, it got baked.

His cat, perhaps miffed at being left alone, knocked over a lamp which started

a fire which, among other unpleasantries, melted his TV set all over his computer. He thought his goose was cooked.

But when he took the Apple to Cincinnati Computer Store, *mirabile dictu*, it still worked.

A new case and keyboard made it as good as new.

Nearly 1,000 Apple dealers have complete service centers that can quickly fix just about anything that might go wrong, no matter how bizarre.

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Accutrack performance is due in part to exceptional manufacturing tolerances made possible by state-of-the-art equipment. In part to our experience as the company that invented and perfected media certifying. And in part to the R&D resources that only a Fortune 500 company like Dennison can provide.

Accutrack disks. Precision built and critically certified to make sure they work. OEMs stake their reputations on them. You can trust them for your data. Models are available for virtually every data and word processing system. Call toll-free (800-225-8715) for the name of your nearest dealer.

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CIRCLE INQUIRY NO. 52

that the CP/M operating system is a "software bus." Technically speaking, the idea is absurd. At a more abstract level, it is certainly true that Digital Research's CP/M will run on a variety of different computers. And—equally as important—some dozens of languages and thousands of applications programs will run on CP/M and whichever physical computer it happens to reside at the moment. Whether by clever design or simple luck, the CP/M operating system has changed the face of computing as we know it—and interchangeability is the key reason for the phenomenon.

Certain microcomputer manufacturers, for their own selfish reasons, have been trying to bury the "bus" idea for some time now. These vendors want *all* your business, and attempt to enforce their wishes via deliberate technical incompatibility between their products and those of other manufacturers. "Single board computers" come from this idea.

We are delighted to report that efforts by the anti-bus manufacturers have resulted in a few spectacular failures. Most notable is the Apple II. This computer was deliberately designed to *not* be S-100 compatible. The Apple II does, however, come with a set of internal connectors that fit the technical description of a bus. It didn't take long for the garage shops to uncover the specifications for the Apple bus, and begin to churn out compatible products for this populous processor. Memory extensions, speech boards, extended graphics boards, 80-column terminal boards, graphics table boards...even an extension CPU board that will run normally Apple-incompatible CP/M. The result? Increased customer acceptance of the computers, and increased sales for Apple. Success lies in making it *easy* for customers to acquire plug-in boards from other vendors.

Various designs abound

Microcomputers are blessed with a wide range of bus designs. The S-100 bus is somewhat married to the 8080 (and similar 8085 and Z80) microprocessor integrated circuit chips. With the notable exception of Alpha Microsystem's 16-bit unit, the S-100 bus is quite incompatible with other designs of microprocessor chips. The 6800 and 6809 micros are most often found in an SS-50 bus. The Apple bus mentioned was engineered around the 6502 device.

More recent designs, such as Intel's Multibus, are happiest with 16-bit processors. Others, like the STD bus, are most often seen in industrial applications. We know of one remarkable effort, fostered by the equally remarkable Guruprem Singh Khalsa, which purports to be processor-independent and incorporates the S-100 design as a subset. The PI-bus has not, unfortunately, been as well accepted as its clever design deserves.

We feel that the idea of bus-oriented computers is good for the computer buyer. In a larger sense, we feel it is good for our industry as well. While you are out computer shopping, include these in your list of questions: "Does this system have a bus? Will boards from other manufacturers work in it?" If either answer is "no," ask the sales person why this is so. It may well be that the explanation is a convincing one, so that the system (or the dealer) offers overriding advantages that make the "bus" question a moot one. In any event, you have learned more about your potential purchase. And that's good, any way you achieve it. ***—TF***

LETTERS

Benchmark addendum

Following is an addendum to the article "Report Card: Benchmark" (IA Aug 81), in which execution speeds were compared for a wide variety of machines. A speed benchmark should only be considered in conjunction with other criteria. One such criterion is the type and accuracy of the arithmetic computations performed by the machine.

It must be noted that two types of internal arithmetic are used by the various Basics: binary and BCD (binary coded decimal) floating point. In each of these cases, the length (in bytes) of the internal representation of a floating point number determines the speed and precision of arithmetic computations. For comparable precision, binary floating point computations prove somewhat faster than BCD; however, decimal oriented computations, such as dollars and cents, are not accurately represented by binary floating point variables.

Over the spectrum of Basics to which I have access, the speed hierarchy is an inversion of the accuracy hierarchy—the highest rated in speed (Microsoft) offers the lowest rating in computational accuracy. Microsoft offers an extended precision variable type, which doubles the computational accuracy at a corresponding execution speed penalty. Not every computation requires exacting accuracy. Frequently, scientific operations are adequately served by some six digits accuracy. Business computations, however, must frequently be accurate to the cent.

Consider, as a representative computation that illustrates the speed/precision dilemma facing your readers, a problem of compound interest: what is the value of principal P compounded at interest I over a period of N intervals? The value is given as: V = P * (1 + .01 * I)↑N.

Regardless of the machine, parameters P, I, N can be selected to exceed the available precision. It is necessary to select values that might be considered "typical" for microcomputer-based applications. Suppose we inquire as to the future value of $10,000 invested at 12% annual interest, compounded monthly, after one year. This value is given as: $V = 1000 * (1.01)^{12}$. We wish the result to be accurate to the cent.

The compound interest problem was adopted prior to testing the various Basics (truly) and the results proved quite surprising: Microsoft Basic, compiled or not, was unable to perform directly the requisite computation, even in extended precision, owing to the internal computational algorithm.

The Basic program used for testing was PRINT 1000 * (1.01)↑12, with answer 11,268.25. In Microsoft 4.51 extended precision, the program was

```
PRINT 1000D0 * (1.01D0)↑12.D0
```

which yielded 11,268.23, off by 2 cents. (Version 5.20 yielded 11,268.24, off by one cent.) These results are quite surprising, since the Basic lost 10 digits of precision in the computation. The ordinary precision computation was off by a nickel—$11,268.20. The error in extended precision computation revealed a choice in computational algorithm with which an entity of the form

```
X↑Y
```

can be computed. Typically, this quantity is computed as the antilog of Y * log(X), i.e., as

$10^{(Y * \log_{10}(X))}$

However, when Y is an integer, an alternative computation of repeated multiplication is frequently faster and more accurate. Microsoft Basic does not utilize the repeated multiplication option. To achieve the requisite accuracy, the following Microsoft program was required:

```
10 DEFDBL V
20 V = 1000D0
30 FOR J = 1 TO 12: V = 1.01D0 * V: NEXT J
40 PRINT V
```

When contrasted with other Basics tested, this program proved by far the slowest.

Before moving on, the published results of speed comparisons between Microsoft Basic interpreted and compiled indicate a speed increase upon compilation by a factor of 3.6, substantially less than the value suggested by an earlier review of the product.

The findings regarding other Basics tested are also interesting.

Micropolis Basic ver. 3.0 uses an internal BCD representation of numbers with 8-digit precision. This version computed the compound interest problem with

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requisite accuracy; however, the exact result revealed the computation did not take advantage of the fact that an integer power operation was required. Apparently Micropolis Basic uses the log/antilog approximation, which was found to err by one cent after compounding the interest over 19 intervals.

CBasic ver. 1.01 utilizes a BCD internal floating point representation with a precision of 14 digits. Additionally, CBasic recognizes the advantage offered by an integer power operation and utilizes repeated multiplications when possible. The 14-digit precision offers higher accuracy than one is ever likely to need and reveals to some extent the reason behind the modest ranking on the speed spectrum. The extent of compilation of CBasic is widely misunderstood: CBasic is not a true compiler. Upon execution, the CBasic program is interpreted by the CRUN interpreter. By separating the syntactical analyzer from the run-time package, the latter need not concern itself with syntax checking. The penalty paid here is that program development/modification is a multiple-step process. There are two sides to every coin.

North Star Basic ver. 5.2 utilizes an internal BCD representation of floating point numbers, and is unique in that a range of precisions is offered from four to fourteen digits, with a different version of the Basic required for each precision. Communication of data between the different versions of Basic is difficult. The standard version offers 8-digit accuracy with special consideration given to integer power operation, and had no difficulty handling the compound interest problem. As indicated in the article, floating point hardware is available, which offered a speed improvement by a factor of 1.7 in the prime number program. Not mentioned in the article is the availability of the COMSTAR compiler for North Star Basic. Taking advantage of compilation by COMSTAR as well as the floating point hardware yielded a run time of 161 seconds for the prime number program.

Finally, it should be noted that the differences between the various Basics in string and disk operations are often of greater significance than either speed or accuracy.

Allen Ashley
Pasadena, CA

More benchmarking

Re: "Report Card: Benchmark" (IA Aug 81), I decided to try the test on my system. The following data was achieved on an Altos micro system, model ACS-8000-7, with a Z80A 8-bit processor with a speed of 4.0 MHz. The operating system is CP/M, and the language is Microsoft 5.2. The program was unmodified for the two runs. The first run was 667 seconds under MBasic, and the second run was 211 seconds compiled.

David E. Wareham
Hoffman Estates, IL

Altos model ASC-8000-2 under Z80A, at 4.0 MHz, under CP/M 1.4 in Microsoft 5.2C came in at 230 seconds. The same model and specifications, substituting only Microsoft 5.2 I, come in at 677 seconds. The Altos coming in number 2 to the TEI 8085 5 MHz is quite an omission from the table. This is the best of the Z80 performers. And it is the "industry standard" CP/M-MBasic combination.

Martin L. Proudfoot, M.D.
Edmonds, WA

On the Heath H8 micro, type Z80, at 2.048 MHz, under the HDOS operating system in Microsoft Basic, the run time was 1,774 seconds.

Arthur L. Thomas
Lawrence, KS

On the Atari 400, with a 6502 processor, at 1.8 MHz, under the Atari operating system in Atari Basic, type I, the time was 1,625 seconds. On the Atari 800, with the same specifications except using the CP/A operating system and Basic A+, the time was 1,523 seconds. By adding the line:

125 GRAPHICS 3,

the Atari will be relieved of a lot of DMA. Execution speed with graphics command and Atari Basic is 1,187 seconds.

Wynn Smith
Oregon City, OR

The Chieftan 9821 micro, type 6809, 8-bit model, at 2.0 MHz, under the Microware OS9 in Microware Basic 09-type C, came in at 213 seconds.

Lewis Hibbets
Specialty Electronics
Enid, OK

VisiCalc update

Re: "Exclusive Product Review: Major Additions to VisiCalc Revealed" (IA Aug 81), as author and holder of the copyright to VisiPlot and VisiTrend, I am grateful for the fine exposure and the complimentary review. The article, how-

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CP-203A

LETTERS

ever, has one tremendous flaw.

Despite the implication that Personal Software was the creative force behind the entire line of "Visi" products, they in fact act solely as publisher and distributor of their software. Micro Finance Systems, Inc. was responsible for the design and implementation of both VisiPlot and VisiTrend, and maintains the program copyright to both products. A similar relationship exists between Software Arts, Inc. and VisiCalc.

It is certainly true that Personal Software has done an exemplary job of promoting and marketing the "Visi" line; this has contributed greatly to the continuing success and growth of these products. It would certainly be a gross misrepresentation and injustice, however, not to mention the creators of these software packages.

Mitchell Kapor
Micro Finance Systems
Cambridge, MA

The article states that "The capacity of VisiCalc for a 48K Apple remains at 254 rows and 63 columns maximum." The "capacity" has never been that large (it was never possible to make an entry in the bottom right-hand corner of the sheet, even with a 64K machine). In addition, the new version of the program absconds with an additional 40% of the available memory in a 48K machine, leaving only 17K available to the user vs. 25K in the original version.

Robert E. Ramsdell
Rockport, MA

In search of solutions

As the president of a hospital consulting firm in Kansas City, I have recently converted much of our data processing activities from time sharing systems to an Apple microcomputer. Our biggest problem has been with software packages that do not live up to their billing. It would seem that a magazine such as yours, or some other organization, could provide a valuable service by organizing a system with the major manufacturers (and advertisers) of software to provide user feedback to an unbiased source. A card included in the software packages for user evaluation, which could be sent directly to your magazine to act as a clearinghous for applications and problems, would allow a prospective user to check out the type of applications and relative success before shelling out his time and money on a lemon. If a manufacturer failed to participate in this type of program, I would anticipate that many people would hesitate to purchase his software. While there would probably be more people responding that are unhappy, I do believe that well designed packages such as VisiCalc, would get the positive responses they deserve.

The second problem is the incredibly inconsistent information about systems compatibility between manufacturers. I do not have any bright ideas about how to solve this problem. It would appear that the burden of responsibility will have to fall upon the manufacturers and catalog dealers to work together on these types of problems. My supposition is that the microcomputer industry will be left open to major manufacturers of hardware and software such as IBM, due to their single source responsibility, unless these types of problems can be resolved.

Frank Zilm
Kansas City, MO

Reader interface

As a medical doctor and owner of a TRS-80 model III 32K diskette microcomputer, I am interested in filing the records of my patients. I would appreciate advice on available software.

Dr. Dino Samaja
Rua Coronel Lisboa, 407
04020 Sao Paulo - Brazil

Where can I find more info on the intelligent videodisc? I was told that Wicat has developed an intelligent videodisc system, together with authoring and production procedures to use it. The first IVD instructional programs have just been completed. Who is Wicat? I'd like to contact them.

Tom Punnch
1888 Granite Lane
Canaan, CT 06018

A non-profit microcomputer club in France requests contacts with similar organizations in the U.S. and Great Britain, especially concerning professional software, reprint rights of magazines and benchmarks, and software for non-profit organizations and radio stations.

Marc Talenton
6 rue des Ormes
94120 Fontenay-Sous-Bois
France

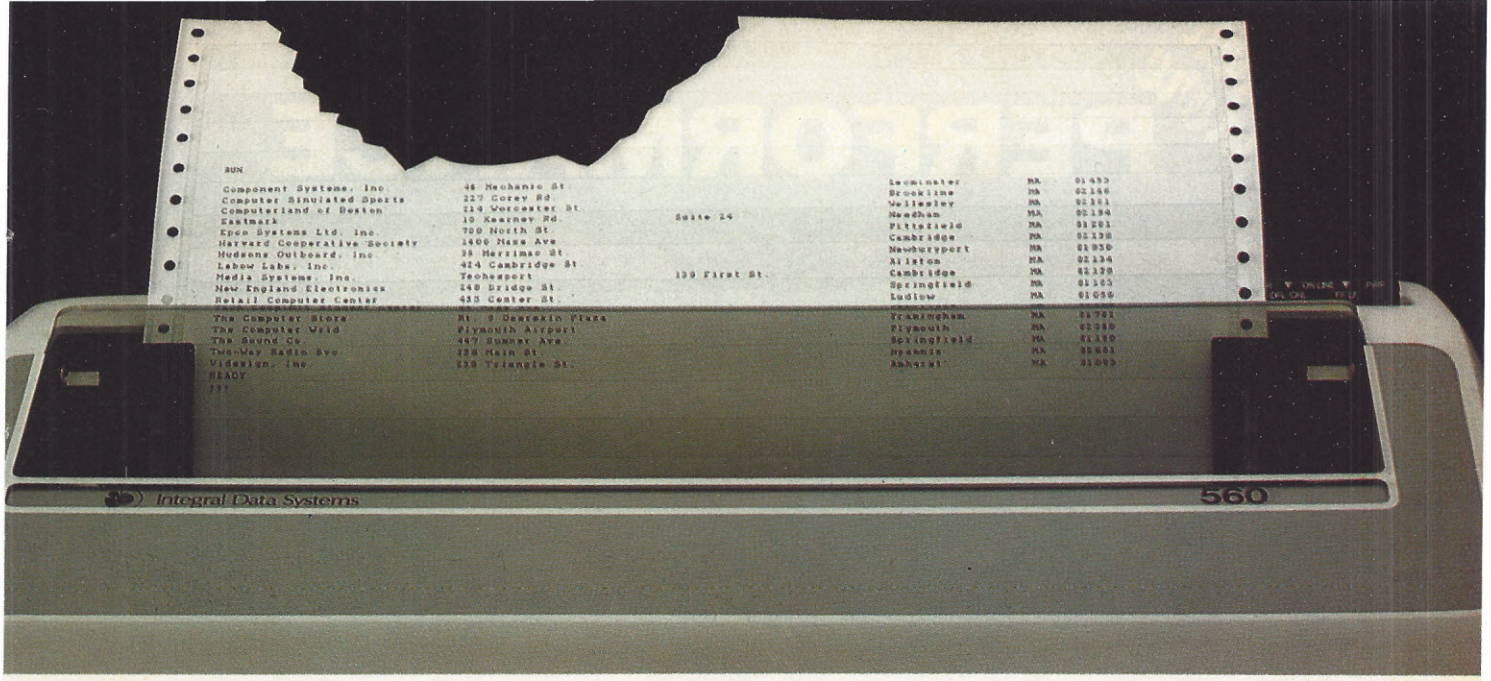
For the record

Re: "Software Review: CBasic Revisited" by Alan R. Miller (IA Sep 81), the program line on page 111:

```
c = fn.arctan(a/b)
```

should read:

```
c = fn.arctan(a,b)
```



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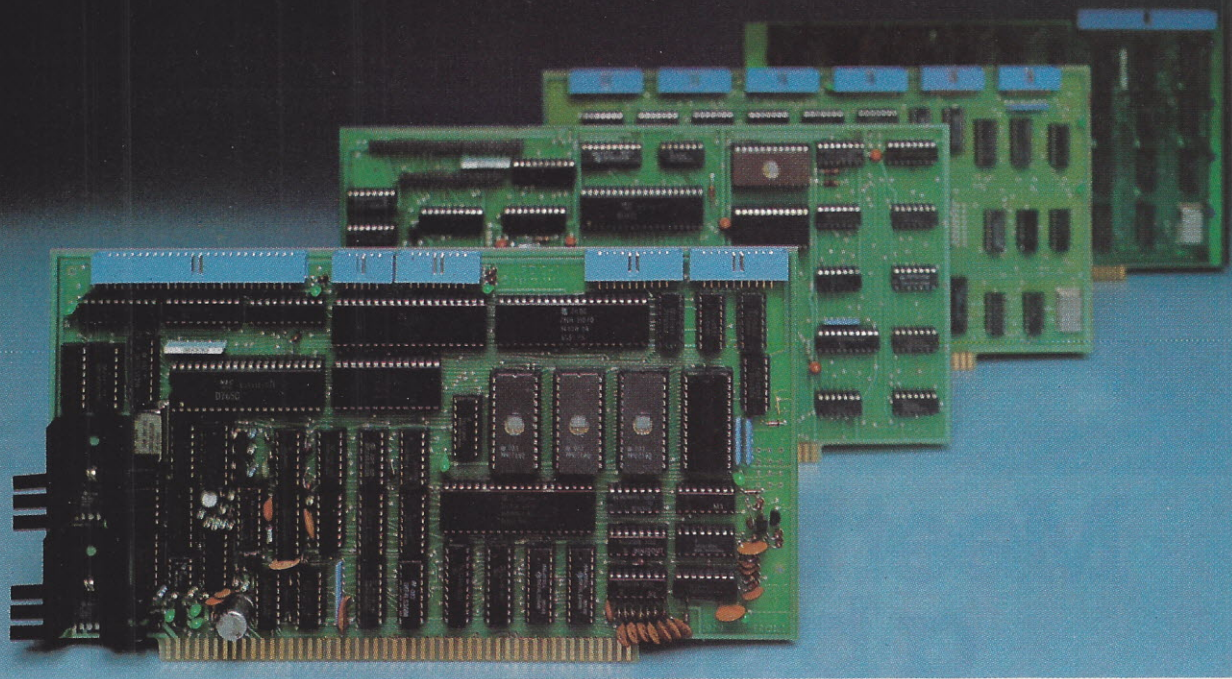

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PSIO: A two-parallel, four serial port board designed around the Z80A family, using its powerful vectored interrupt structure. The board is designed for use in multi-user systems and is currently running with the FDC-I and MP/M®. As many as 14 PSIOs may be daisy-chained in one system under interrupt control.

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UPDATE

Small business computer shipments to be dominated by low cost systems

Unit shipments of small business computers priced under $20,000 will exhibit the highest compound annual growth rate of all market segments, according to a recent study by Venture Development Corp., Wellesley, MA. Shipments will increase 33.5% annually from 1980 to 1984, accounting for almost 50% of shipments by 1984.

The report segments the industry into three price/performance categories: level I systems are priced under $20,000; level II systems $20,000 -50,000; and level III systems $50,000 -100,000. These levels are based on end user prices of "basic" systems. (The addition of peripherals and software options can greatly increase system cost.)

The growth of level I systems will be fueled by price and technological advances. The under $20,000 price tag, coupled with their advanced capabilities, make these systems attractive, especially to the very small businessman. Lower priced printers and less expensive storage devices will enable the purchaser to obtain the performance of a level II system at a level I price.

Unit shipments of level II small business computers will grow by 26.4% annually. These systems will lose market share, and will account for less than one-third of 1984 shipments.

Level III unit shipments will grow by 27.4% annually. Market share of systems at this level will remain relatively unchanged through 1984.

Technical information stored on computers

Engineers may be able to use computers to store, call up, and otherwise display some technical information not currently published in professional journals as a result of a study recently begun by Battelle Columbus Laboratories, Columbus, OH.

In a four-month study sponsored by the American Society of Mechanical Engineers (ASME), Battelle researchers are examining ways to use computers as an alternative to publications for communicating with the technical community.

ASME is a technical and educational organization with a membership of 100,000 individuals, including 17,000 student members. It conducts one of the largest technical publishing operations in the world, which includes codes, standards, and operating principles for industry.

Newspaper on a chip becoming a reality

The first private electronic edition of a complete newspaper was recently introduced. Radio Shack, Fort Worth, TX, revealed the pilot project in cooperation with the Tiffin, OH *Advertiser-Tribune*.

Subscribers to the newspaper will be able to see the electronic edition via videotex, a method of electronic communications that transfers information over standard telephone lines for display on standard television sets. Users will require an inexpensive videotex terminal, or a personal computer equipped with the simple hardware and software necessary to permit it to act as a terminal.

Publisher Kaj Spencer states, "We believe that some form of electronic newspaper will emerge as an important information medium in the near future. We want to be involved and have a hand in developing the future landscape."

Europe's first consumer electronics show postponed until 1982

The European Consumer Electronics Show (E C E S 81), originally set to take place at Nuremberg, Germany, during May 10-13, 1981, has been rescheduled for May 1982.

E C E S is a trade-only event, incorporating the latest developments in micro technology within consumer electronics products for home, office and personal applications. The exhibition venue remains the Nuremberg Fair Centre, and revised exhibition dates will be announced soon.

The decision to postpone the event, sponsored by the Trade Fairs International Ltd., W. Midlands, England, followed discussions with existing and potential exhibitors.

The talks indicated that manufacturers in new product areas are encountering difficulties in matching supply with demand levels. Other manufacturers in the more established consumer electronics field are being forced increasingly to concentrate their efforts on maintaining an existing market share, and therefore have themselves postponed previously planned new product launches.

The show represents a new exhibition concept for the European electronics market.

Organization issues call for technical papers

A call for papers has been issued for the Computer Network Performance

Symposium to be held April 13-14, 1982 at the University of Maryland, College Park, MD. The symposium is jointly sponsored by the Assoc. for Computer Machinery's Special Interest Groups on data communications (SIGCOMM), measurement and evaluation (SIGMETRICS), and operating systems (SIGOPS).

Papers are expected to focus on public and private packet switching networks, local area networks and vendor network architectures. The actual measurements and analysis of performance in these environments may address protocol standards, hardware and software design and implementations, as well as end user expectations.

Additional information may be obtained from the symposium chairman, Dr. David C. Wood, The Mitre Corp., W-701, 1820 Dolly Madison Blvd., McLean, VA, 22102, (703) 827-6394.

Dedicated word processor said to be in decline

With the invasion of microcomputers quickening, the end of the dedicated limited word processor is in sight as users realize they can have word and data processing in a single multi-purpose system with resulting economy, efficiency and higher productivity, according to Robert F. Wickham, vice president of marketing for Vector Graphic, Westlake Village, CA.

Wickham quoted the Information Word Processing Assoc.'s own recent survey, which indicated that more than 20% of the group's members are responsible for data processing and other information tasks as well as word processing. Wickham noted that the association is in the process of changing its name to the International Information/Word Processing Association.

Citing the more visible evidence of the move toward combined functions, Wickham noted that many microcomputer manufacturers are already bringing out systems that perform both word and data processing, along with the applications software necessary to make this multi-use approach workable.

Photo agency is catalogued in computer data base

The first computerized stock photo agency puts photo researchers, art directors and editors within phone's reach of over 5,000,000 photographs—and the photographers who shot them.

Unlike traditional agencies that charge a search fee, callers have access to the data base without charge.

According to Bert Eifer, president of Compu/Pix/Rental, Los Angeles, CA, the PhotoBank cuts the cost and frustration of securing photos for advertising, publishing, collateral materials, as well as packaging and displays.

"We function as a referral agency, rather than a photo warehouse. The client profits by direct contact with the photographer who submits his photos for approval, and who often has helpful expertise on the subject.

"Our clients gain instantaneous access to encyclopedic classifications of subjects by a phone call. The librarian provides the caller with the names of one or several photographers whose specialty matches the need", Eifer notes. "From there, the relationship is strictly client-photographer, with no middle-man to cloud the issue or increase the picture rental fee."

Foundation awards microcomputer equipment to educational projects

Nearly $130,000 worth of microcomputer-based systems have been awarded to 22 educational groups by the Foundation for the Advancement of Computer-Aided Education.

This is the fifth set of grants made by the foundation since its founding in October 1979, and raises to approximately $625,000 the value of grants given to educational institutions and individuals. The foundation is a nonprofit corporation established to support and develop new methods of learning through the innovative use of small computers. Most of the systems provided under the grants include Apple II personal computers, manufactured by Apple Computer Inc., the foundation's principal sponsor.

French government supports videotex marketing programs in U.S.

The French government recently announced that it would vigorously pursue recent videotex and teletext successes in the U.S.

A message to Antiope Videotex Systems, Inc., from the newly-named minister of Post Office, Telecommunications and Telediffusion, Louis Mexandeau, said "The recent success of French technology in the U.S. constitutes the first stages of a continued and vigorous action on the part of French industry."

Spelling out those successes, Mr. Mexandeau cited "the adoption of the Antiope standard for broadcast teletext tests being conducted on the west coast by CBS, NBC, Group W and KCET-TV.

Jurisprudent Computerist

By Elliott MacLennan
Attorney at Law

Soliciting Capital Investments

Last month's column discussed tax sheltered limited partnerships as a means to raise money for new products. Its key feature is that you do not dilute ownership of your company for seed capital. This month's topic is a seven-step procedure for packaging a new product in preparation for presentation to investors.

At this point, I could easily accomplish my task of explaining how to design a new product package and bring this column to a short conclusion by saying hire a battery of specialists to do it for you. There is a problem with bringing in specialists too early (if at all)—you need to pay them. If you ask product developers the right questions, they become their own specialists.

The first step is to describe the product in technical detail. Summarize your technical language and convert it into simple English. This step will help you discover if a product family can be generated from one concept. For your first venture, select a highly needed product that can rapidly penetrate the market. This will create a positive track record for future product developments.

The second step is to determine what problem you are solving.

Step 3 raises the questions: Who will use your product? What benefit will your user receive that he does not currently have?

Step 4 concerns competition. Who is currently competing with you? Who will want to compete once your new product penetrates the market?

The fifth step is to develop a target market. Most computer product developers I have encountered have exacting knowledge of the market for their new products. Therefore, identifying the market is usually not the problem; having the financial reach to grasp the market usually is. Describe how you will approach the market (i.e. advertising, computer stores, mail order, etc.). Then decide whether an international market exists for your product. Decide whether you want your investor to share in your international profits or not.

Next, predict the minimum-to-maximum new product in which range you can reasonably expect to sell, with a penetration-peak-obsolecense time frame of your product. Remember to consider what the seed capital will do to expedite market penetration.

The final consideration is profit ratio. How much can you afford to give up to an investor? Note the attitudinal shift here. A venture capital group tells you how much profit (and ownership) it will take. In a tax sheltered limited partnership, the opposite is true. Break down your costs to make the prototype into hard and soft costs. Hard costs are out-of-pocket expenses you actually incur: machine time, materials, consultants. Soft costs include your time, energy and skill, which will not be repaid. If you must interrupt your make-a-living time to design a new product, you should be compensated.

The I.R.S. encourages R & D writeoffs

It is important to remember that you are not alone. The IRS helps to finance your brainchild by permitting you to pass on the tax writeoff to your investors. This is no gimmick; the IRS encourages R & D writeoffs. The 25% R & D credit is now a reality. Therefore, if someone invests $100,000 in your new product, he has just eliminated $25,000 in income taxes—not $25,000 in *income* but $25,000 in *taxes*. A tax credit offsets your taxes dollar for dollar; deductions offset taxes only to the extent of your tax bracket.

In addition to the 25% R & D tax credit of $25,000, your investor benefits from an R & D deduction. If $100,000 of your investor's capital is allocated to R & D, he gets a tax deduction equal to his tax bracket. (Assume 60% Federal and State combined.) Your investor gets a $60,000 deduction. Under present tax rates, your investor will have to earn over $125,000 before he pays a penny in taxes. If the investor earns less than $125,000, the government owes him money! Thus far, your investor's real cost is not his $100,000 cash outlay; it is $15,000 because of tax breaks. This concept is called "negative borrowing" from the IRS by tax lawyers.

The function of using the seven-step formula is to force you to record your new product concept on hard copy. The formula also provides a comprehensive core prgram that the legal and tax planning can incorporate.

Next month's column will discuss how to attract investors and the new 25% R & D tax credit. □

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The SYSTEM 2800, designed for business, industrial and educational applications, is now available with a 20 MByte Winchester Hard Disk and a 20 MByte Tape Drive for disk backup. Created to be innovative and competitive, the SYSTEM 2800 utilizes our existing line of field-proven and dependable "2nd Generation" S-100 Memory, Z80 Processors, Disk Controllers and Serial I/O boards.

As a family of expandable microcomputers intended for single and multi-user applications based on CP/M*, MP/M* and OASIS**, the SYSTEM 2800 contains many big system features. Outstanding characteristics such as FAST operation make it a clear market leader. In fact, the SYSTEM 2800 is one of the fastest Z80-based systems recently benchmarked by Interface Age magazine.

*CP/M and MP/M are Registered Trademarks of Digital Research

**OASIS is a Trademark of Phase One System, Inc.

Other featues include the capability to BOOT from any drive including the hard disk, and extensive error recovery. The error recovery prompts the user with detailed error messages and prevents system lock up, all too common to many other systems.

Designed for easy service, the SYSTEM 2800 comes with two 8-inch drives: a choice of single or double sided, double density floppies with up to 2.52 MBytes of formatted storage; 10 or 20 MByte Winchester hard disk; and 20 MByte tape drive for disk backup.

These enhanced features result in a highly reliable, quality built, state-of-the-art microcomputer that gives you the cost/performance edge you need to be a leader in your field.

Dealers, OEM's and System Integrators share many common needs. Not the least of these is dependable products. That's why we back our SYSTEM 2800 with our established reputation for high quality, superior support, prompt and courteous service, an inclusive one-year warranty and comprehensive dealer support program.

Take the next logical step. See your nearest computer dealer, or contact us for the complete story on our S-100 family of board products and enhanced systems.

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by Patrick and Leah O'Connor

Robotwar

The Robotwar game from Muse Software, Baltimore, MD, written by Silas Warner, runs on an Apple II with 48K RAM, disk drive(s) and a printer.

It is not as much a game as an operating system that exists in a different world from the "virtual machine" normally simulated by DOS. In the Robotwar operating system's universe, there are no more wars with human combatants; instead, each side in a military conflict battles against its opponents with robots. When the robots are placed in the battlefield, combat begins. The human operator at the computer console does not control his robot's actions directly. Rather, the robot is on its own and must be able to survive by being "smarter" (or luckier) than its adversaries.

The battle simulation is quite realistic. Up to five robots appear on a high-res battlefield display. Each is represented by an identifiable geometric figure. To attack, robots fire shells that can hit opponents or explode at a selected distance from the attacker. Audible detonation sounds are produced while the visible shell burst is displayed on the screen. Defense is mainly by evasive action. Sensory input takes the form of a radar unit on each robot. It is visible as a rotating "vector" that sends out visible radar bursts timed with sonar-like beeps.

Suppose, for a moment, that the robots were controlled by paddles or joysticks, and the battle sequences just described were the consequence of human operator controls. Then, Robotwar would be a nice little game, similar to most other combat-type games on the market, but not particularly notable.

This is not the case. The robot's human alter-ego does not directly participate in the attack and defense. The attributes of the robot—its strategy, in other words—is pre-defined at the beginning of the game, and the robots are on their own in the melee.

Each robot's attributes, characteristics and battle strategy are programmed by the human "owner" before it is put onto the battlefield. The way it attacks and defends itself are determined by the program its owner has written. The robot is a virtual machine, assembled out of software and designed to act and react in certain ways by its designer.

This is the ultimate programmer's game. A robot language similar to Basic is used to define the robot. The robot is given a name and its attributes are defined by a list of instructions describing the way the robot will move, when it will fire its cannon, how it reacts to incoming information from its radar unit, where it should look with its radar unit and aim its cannon.

The source program, once written, is compiled into an object program in some less-high-level language. This process is called assembly in the documentation, perhaps to suggest an analogy to building a robot physically out of mechanical parts.

Debugging the code can be accomplished easily; a number of software aids such as a simulated test bench run of the program (including such things as single-stepping through the commands) are available—with hardcopy, if desired. Error diagnostics provided during the assembly process—and at other times in checkout—are reminiscent of diagnostic messages available in very high-level languages. By itself, the language whose virtual machine is a robot rather than a computer, is an impressive accomplishment.

The writing and editing of the source program are accomplished with a text editor that has features as powerful as any word-processor we've seen. As a word-processor alone, with the ability to print-out text generated by the programmer on a standard printer, the disk is already worth more than the listed price.

The inside cover of the manual says it was prepared using the Super-Text word processor from Muse. We suspect that the program contains large chunks of Super-Text, a program that must be awesome in its own right, if this is any indication.

The manual that describes all this is a classy 80-page booklet that contains the language, editing, assembling and combat aspects of robot use. There is a sample robot program that can be loaded, edited and assembled to get experience.

Several robots already exist on the diskette with the program, and are used to see how robots work on the battlefield. Robots may be stored and retrieved on disk as source code or object code. We envision a users group developing to exchange robots (as programs on disk) between users.

We took the program to DeVry Tech, Chicago, IL, where Patrick teaches. With the assistance of a student we loaded and ran the program to see how it works. The student, Larry

This is the ultimate programmer's game

Farrell, immediately went bananas over the program. He enlisted one of his buddies, Mark Hougaard, into the Robotwar users group over the weekend.

On Monday we found Hector II, a robot the two had assembled using the Robotwar language. Larry and Mark did a good deal of the real evaluating of the system by living in the universe over that weekend. They were both effusive in its praise, and had only one slight quibble: the documentation didn't mention that mathematical expressions are evaluated left-to-right, instead of MDAS, by the robot language.

Hector II was touted as unbeatable by the robots already on the Muse diskette. While this did not turn out to be true when we ran it through its paces, it does at least as well as the others (SQUARE, RANDOM, BOTTOM, MOVER and SCANNER) originally included on the game diskette. If you have a copy of Robotwar, and are just learning how to write programs as you read this, Hector II might make a nice second robot to try assembling after completing the sample from the manual.

From the accompanying listing of Larry and Mark's program, it should be possible to get a little feeling for the Robotwar language. It is similar to Basic, but substantially different in certain respects. Lack of line members is no big loss; the labels, like MSCAN and FIRE, identify branch points in a more comprehensible way than line numbers ever would. In Basic, the statement "C + 1 TO C" would be "C = C + 1". The ASSIGNMENT operation in Basic has always puzzled students in class when they see it for the first time. "There can't be," they say, "a number that's equal to itself-plus-one." But the '=' sign doesn't really mean equals, it means MOVE C + 1 to C.

Later, we have to explain that, in an IF statement, the '=' sign really does mean equals. If the neophyte programmer learned to program by doing Robotwar, there would be no

Continued on page 158

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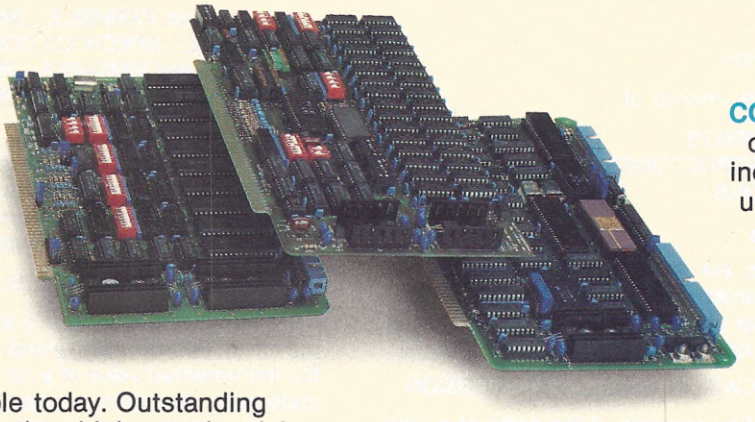

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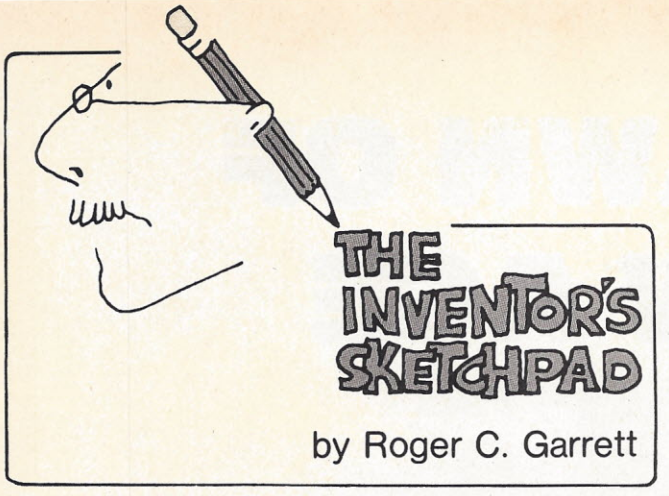

by Roger C. Garrett

More on "C" Programming

In last month's column, I began a description of a programming language I have developed based on the C language. I described the basic philosophy behind it and introduced the data structures and some of the logical and arithmetic operators. This month, I continue the discussion by describing most of the executable statements.

Execution section

The executable portion of a function follows the data definition section and has the following general format:

executable__section
———
———
EXECUTABLE STATEMENTS
———
———
end__executable__section

The executable statements consist of:

ASSIGNMENT STATEMENTS
FLOW OF CONTROL STRUCTURES
FUNCTION INVOCATIONS

Assignment statements

Assignment statements are the main data manipulation statements in any programming language. In C.plus, they have the following general statements in any programming language. In C.plus, they have the following general format:

set VARIABLE__SPECIFICATION equal__to EXPRESSION ;

The variable__specification consists of the name of a valid variable (i.e. one that has been defined in the data definition section). It may include a subscript specification in the case of array variables. It may include dot notation in the case of structure elements.

The expression consists of variable__specifications, function invocations and operators. We may think of the operators as being logically divided into two categories, namely unary operators and binary operators.

Unary operators

The valid unary operators are:

address__of
value__pointed__to__by
incremented
decremented
negative
complemented

In addition to the above standard operators, certain value-returning functions can be considered as unary operators.

The address__of unary operator

The address__of unary operator takes the following form:

address__of VARIABLE__SPECIFICATION

For example:

set x equal__to the address__of y;

would determine the machine-dependent address of the variable named *y* and place that address into the variable named *x*.

The value__pointed__to__by unary operator

The value__pointed__to__by operator takes the following form:

value__pointed__to__by
POINTER__VARIABLE__SPECIFICATION

For example,

set p equal__to the value__pointed__to__by r ;

would get the value of the variable that is pointed to by the pointer variable *r* and place that value into the variable *p*. Note that *r* must be a pointer type variable. In general, the variable *p* should have the same (non-pointer) type as the variable that is pointed to by *r*, i.e. if *P* is the integer, then *r* should be pointing at an integer variable.

Note also the use of the word "the" in this statement. It gets replaced by the compiler with a null character, so that it actually has no effect on the compilation. It does, however, make the statement a bit easier to read—one of the main reasons for using C.plus.

The incremented and decremented unary operators

The incremented and decremented operators have similar forms, as follows:

incremented VARIABLE__SPECIFICATION
VARIABLE__SPECIFICATION incremented
decremented VARIABLE__SPECIFICATION
VARIABLE__SPECIFICATION decremented

The incremented operator causes the contents of the named variable to be incremented by 1. The decremented operator causes the contents to be decremented by 1. The position of the operator before or after the variable__specification is significant. For example, in

set x equal__to incremented y;

the content of the variable *y* is incremented and the result is put into *x*. So both *x* and *y* end up with the same value, namely the incremented value of *y*. (If *y* had contained 34 before this statement, the both *x* and *y* would contain 35 after the execution of this statement.)

On the other hand, if the incremented operator appears *after* the variable__specification, then the incrementation operation occurs after the assignment operation. So, in

set x equal__to y incremented;

the value of *y* would be placed into *x* and then *y* would be incremented. If *y* had the value of 76 before execution of this statement, after execution *x* would be equal to 76 and *y* would be equal to 77.

The same principles apply to the decremented operator.

The complemented unary operator

The complemented operator has the following general format:

complemented VARIABLE__SPECIFICATION

This operator returns the bit-by-bit complement of the contents of the specified variable. Note that his operator cannot appear after the variable specification, as is the case with incrementing and decrementing.

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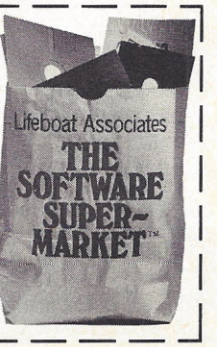

For example, in

set x equal__to complement y ;

if *y* contains the bit pattern 00101110, the complement of this (i.e. 11010001) will be placed into the variable *x*. The content of *y*, however, remains unchanged.

Binary operators

Any operator that acts upon two values and returns a single value is considered a binary operator. The valid binary operators are:

plus
minus
multiplied__by
times
divided__by
modulo
left__shifted
right__shifted

The following examples should be sufficient to explain most of the common binary operators:

set x equal__to y plus z;
set x equal__to y minus z;
set x equal__to y multiplied__by z;
set x equal__to y times z;
set x equal__to y divided__by z;

Note that *multiplied__by* and *times* are equivalent functions. The more traditional forms of these operators are also available as follows:

C.plus version	*Traditional*
plus	+
minus	–
multiplied__by	*
times	*
divided__by	/

The rest of the binary operators require a little more explanation.

The modulo binary operator

The *modulo* binary operator has the following general format:

VARIABLE__SPECIFICATION__1 modulo
VARIABLE__SPECIFICATION__2

This operator returns the remainder after variable__specification__1 is divided by variable__specification__2. For example, in

set x equal__to 5 modulo 2 ;

the variable *x* would receive a value of 1, since 5 is divided by 2 gives 2 with a remainder of 1. The *modulo* operator operates only on integer values and returns an integer value. Of course the 5 and/or 2 could have been integer variables rather than constants.

Left__shifted and right__shifted binary operators

The *left__shifted* and *right__shifted* binary operators have similar functions. In each case, a value is shifted in a bit-by-bit manner. Left-shifting is comparable to multiplying by a power of two and right-shifting is comparable to dividing by a power of two. No bit-wise wrap-around occurs.

For example, in

set x equal__to y left__shifted z bits;

the value contained in the variable *y* is shifted left the number of bits specified by the variable *z* and the result is placed into *x*. The word "bits" compiles into a null word and is included only to make the statement more readable.

Increment and decrement statements

It is often quite handy to be able to increment or decrement the value of some variable. It can, of course, be done with an assignment statement such as

set the number__of__characters equal__to the
the number__of__characters plus 1;

but it does not read well. The function of the statement is not intuitively obvious. So we have a special set of statements to handle it. They have the following forms:

increment VARIABLE__NAME;
decrement VARIABLE__NAME;

For example:

increment the number__of__characters ;

would add one to the number__of__characters variable. I regret that, due to the design of C, we cannot have the more general form

increment VARIABLE__NAME by INCREMENT__VALUE ;

so that we could have a statement such as

increment the number__of__characters by the word__length ;

We will just have to wait for the developers of C to make a few changes. Or maybe our readers would like to try writing a compiler for Structured English.

Next month's concluding installment will describe the flow-of-control structures (the decision and iteration structures) and will present the listing of the C.plus file that defines all of the necessary keywords. □

Program on page 160

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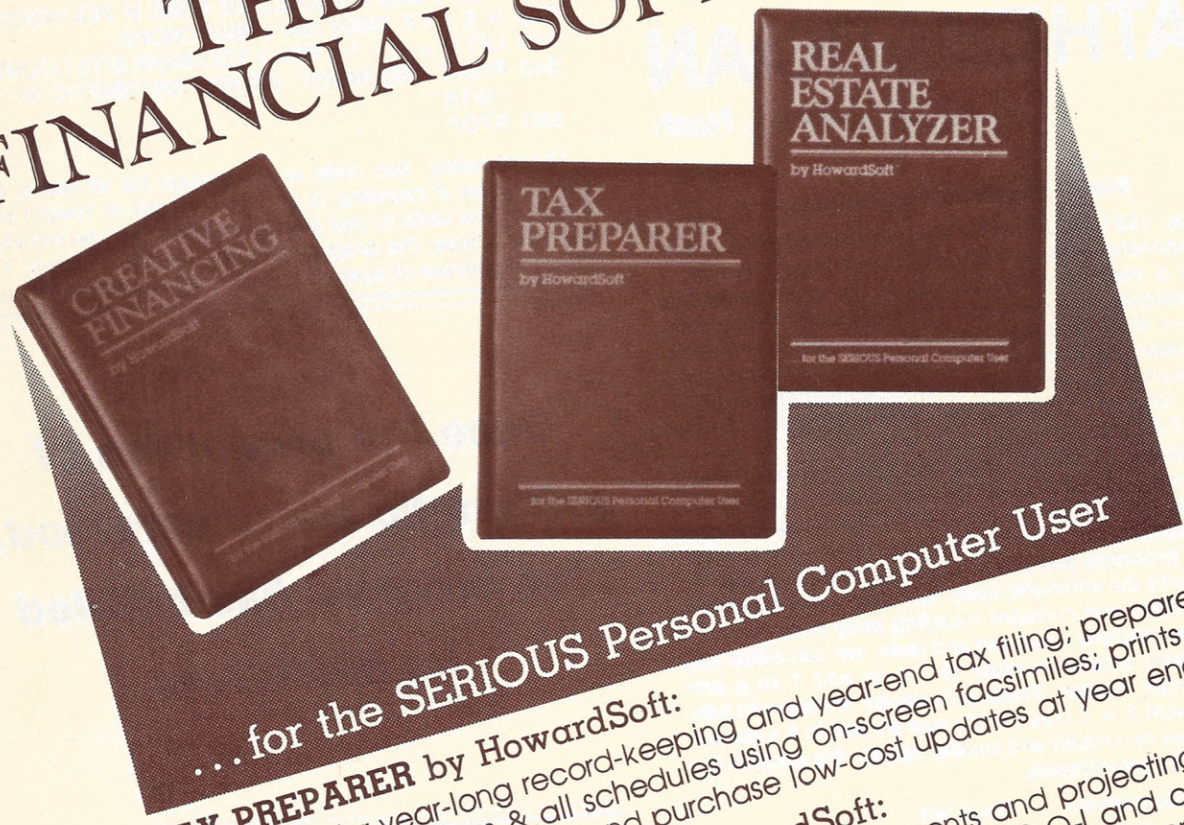

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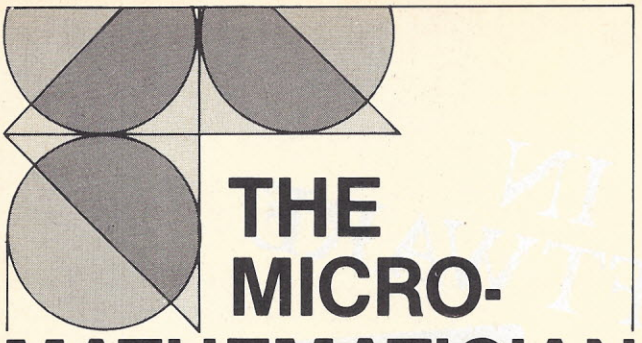

THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Binary Machines That Round

The May 1981 column gave the program PRECN, which works reasonably well on most machines. It is, however, a variant of a method originated by Dr. M. Malcolm in the *Communications of the ACM,* Vol. 15, pg. 949-951, November, 1972. I have discussed the portability of this code (and some of the attendant headaches) in the Proceedings of the Second Rocky Mountain Symposium on Microcomputers of IEEE Computer Society, Long Beach, CA (publication number 78CH-1387-OC, pg. 222-239).

Unfortunately, machines that perform rounded binary arithmetic will give strange answers in either variant of the precision program. Digital Equipment PDP-11 computers have such arithmetic, as Dr. Jacques Gelinas pointed out in a letter. To see the problems and the changes that can be made, we must delve into the arithmetic itself. Consider a representation in 4 binary digits and consider rounding away from zero.

To find the machine precision and radix, we can either add a progressively smaller number to 1.0 or add 1 to a progressively larger number. These procedures are taken in turn.

We represent A = 1.0 as 1.000; now we add to A a number B, which takes on smaller and smaller values. We enclose the rounding bit in parentheses.

B	Intermediate sum	Rounded result	A + B = ? = A
2^{-1}	1.100	1.100	N
2^{-2}	1.010	1.010	N
2^{-3}	1.001	1.001	N
2^{-4}	1.000 (1)	1.001	N
2^{-5}	1.000 (0)	1.000	Y

The machine precision is computed as 2^{-4}, even though the correct value is 2^{-3} (represented as 0.001). The radix is not found by incrementing A and adding the machine precision.

A: = A + 1 gives A as 10.00 binary
A + 2^{-4} gives 10.00(0) rounding to 10.00 binary

The radix is thus computed as 10.00 binary, or 2 decimal. As mentioned, we can also try to increase A to find the radix first.

A	A + B	(A + B) Rounded	(A + B) = ? = A
1	10.00	10.00	N
2	11.00	11.00	N
4	101.0	101.0	N
8	1001.	1001.	N
16	1000(1).	$1001*2^1$	N
32	1000(0)1.	$1000*2^2$	Y

The radix is found by now increasing B until (A+B) is bigger than A. For B = 2 we have, in binary A + B = 1000(1)0, which is rounded to $1001*2^2$. The radix computed by forming (A + B) – A is

$(1001-1000)*2^2 = 1 \times 2^2 = 4$

Thus neither method is satisfactory for this type of machine. In order to get around these difficulties, we must include extra code for such machines. For the program given in the May issue, we could add the following lines of code.

```
274 REM ADDITIONAL CODE FOR BINARY MACHINES
275 IF A = 2 THEN 470
470 REM TEST FOR BINARY ROUND
480 LET E = (A + 2 * B)
490 LET F = (A + 4 * B)
500 REM D = A + B HAS VALUE 1.0
510 REM E AND F SHOULD BE SAME IF ROUNDED
520 IF E <> F THEN 280 \ REM CHOPS
530 LET C = C - 1 \ REM 1 TOO MANY BITS COUNTED
540 PRINT "ROUNDED" BINARY ARITHMETIC IN", C,
    "BITS"
550 STOP
```

Unfortunately, this code is not enough for all cases. We still do know if rounding is away from zero or toward plus infinity. Extra code to test such possibilities can be included, but after a time, the program begins to become messy. The principal purpose of such programs is to encourage the user to think how the machine works with numbers. Once the properties of the arithmetic are understood, the program has fulfilled its objectives.

Once the properties of arithmetic are understood, the program has fulfilled its objectives

The PDP-11 shows another interesting feature of floating point numbers, which is also part of the Draft IEEE Binary Floating-Point Standard (P754). The actual arrangement of the PDP-11 floating-point "word" of 32 bits (2*16 bit words) uses

23 bits for the mantissa
1 bit for the sign
8 bits for the exponent and its sign

However, 23 bits are not enough to give a machine precision of 2^{-23}; we need 24. Floating point numbers are normalized so that the first significant digit is just to the right of the implicit radix point. In our 4-bit example, 3 is represented

$.110 * 2^2$

An un-normalized equivalent is

$.0110 * 2^3$

To normalize, we shift left and decrement the exponent until a non-zero digit is in the first position. For binary machines, this is *always* a 1. Therefore, we consider it, along with the radix (binary) point as implicit, thereby gaining one bit of precision at no cost in memory. This "hidden bit" must, of course, be put back in accumulators. PDP manuals state that various guard bits (digits) may be used in the floating point hardware. Also, optimizing compilers may keep numbers in accumulators and not round them, thus frustrating precision-finding programs.

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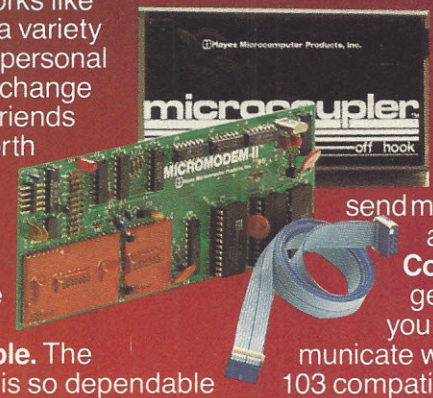

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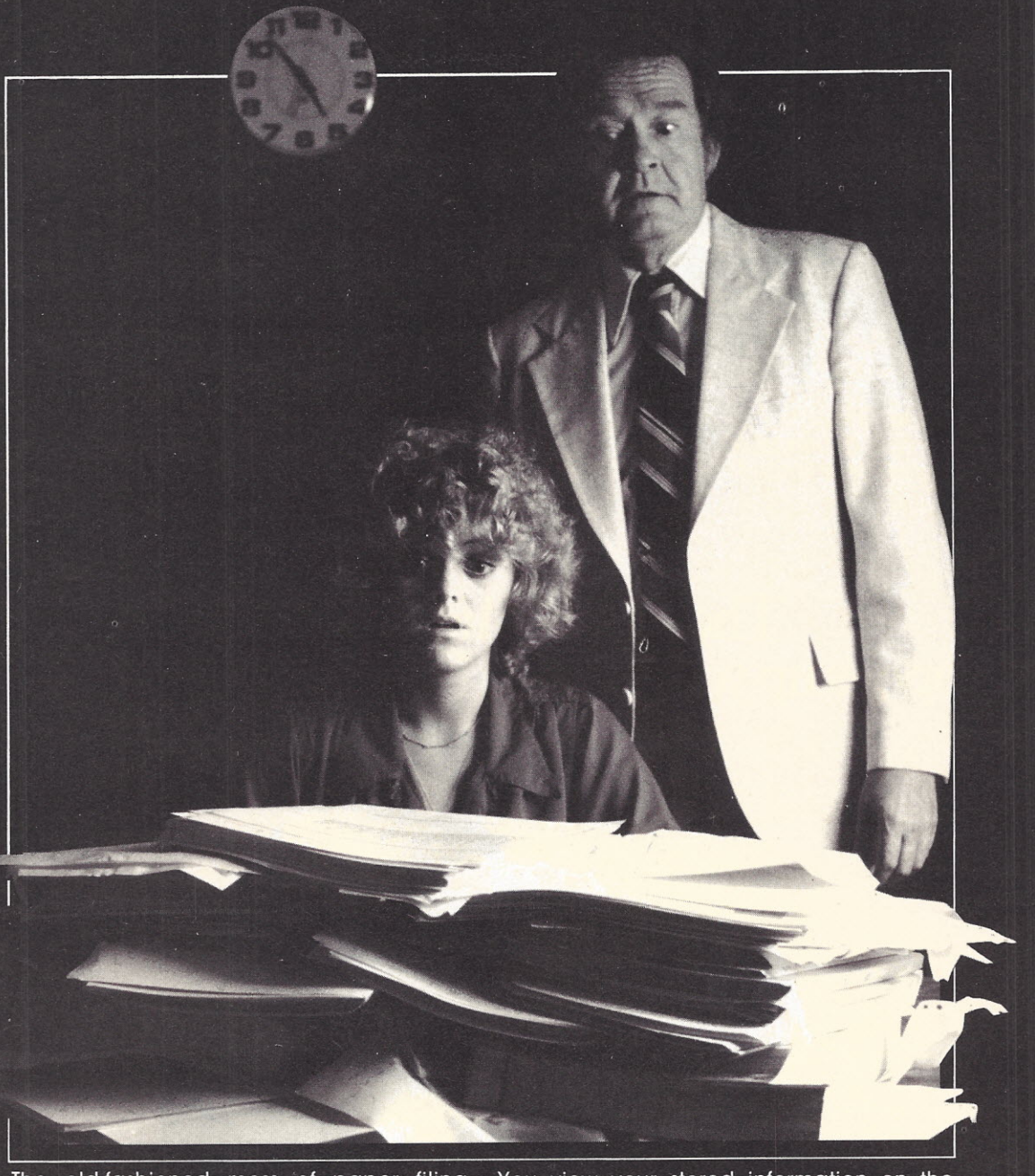

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All the above ideas are good reasons why standardization of floating-point arithmetic will assist users by removing one source of differences between results of the same program on various machines. I have on several occasions had to spend valuable time verifying that such differences were not the result of program error. In one case, a service bureau spent a week looking for an error in a program I had implemented. The program computed some vectors describing a system of interest. For certain inputs, some of the vectors could only be determined to lie in a plane. The program would then choose an orthogonal pair of vectors in that plane. The service bureau programmers were simply told to convert the program from a Univac 1108 to an IBM 370. With different arithmetic and rounding, the pairs of vectors generated by each machine were entirely dissimilar, and a grave source of frustration to programmers who tried to "fix" things.

Let's look at the exponent range of floating point numbers. We can write simple loops to find the biggest and smallest representable numbers. For the largest, we take our knowledge of the floating-point arithmetic and fill every digit of the mantissa with (radix − 1). Thus for the decimal arithmetic Radio Shack/Sharp Pocket Computer, we can start with A = 9.999999999. Letting B = 10 (the radix), we now execute

```
100 LET A1 = A
110 LET A = A * B
120 GO TO 100
```

Eventually an overflow occurs and execution is halted, leaving A1 as the largest representable number. On some machines, it may be necessary to print A1 on each pass through the loop. For the Pocket Computer, we find A1 = 9.999999999E+99. The smallest number is likely to be 1.0 * B^{-M}, where M is the largest exponent value. Some machines, may not use a signed exponent, but assume that the value of the exponent is implicitly to be reduced by some shift. This may result in an unbalanced exponent range. We can discover the smallest representable number using the code.

```
10  LET A = 1.0
20  LET B = (radix)
30  LET A1 = A
40  LET A = A/B
50  IF A <> 0 THEN 30
60  PRINT A1
70  STOP
```

On machines that treat underflow as an error, this will fail at line 40 at some iteration, while machines that underflow to zero will stop normally. The Pocket Computer underflows to zero with A1 = 1.E−99. Also, 0.9999999999E−99 evaluates to zero.

On the Pocket Computer, it is easy to set the values of variables because there is no input/output conversion between the decimal notation used externally and the internal non-base 10 representation.

Error corrections and updates

Re IA Sept 80, page 34, several readers found that SCRUNCH was hard to acquire. I believe new marketing arrangements are being made. SCRUNCH is a collection of numerical methods in Basic translated from reliable Fortran codes by Kris Stewart who is currently at the Jet Propulsion Lab.

Also on page 34, lines 10, 11, 13, 18, 26, 34, 35 replace capital S with capital Z.

On page 36, listing 1B, line 1140 should read

1140 if Q< = T9 THEN 1180 (i.e. 1180 instead of 1190)

Re IA May 81, page 30, on line 26 replace *argument* with *arrangement*.

On page 33, line 180 of listing 1 should read

180 IF D > A THEN 160 (i.e. D instead of A + B to force storage of the sum)□

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CIRCLE INQUIRY NO. 84

Learning with Micros

by Louis E. Frenzel

Reader Responses

This month's column focuses on feedback we've received from readers.

In my April, 1981 column, I discussed the potential of a learning system made up of a microcomputer and a video disk unit. This combination forms a powerful and very effective teaching tool. Such systems are now technically feasible and are being used and tested in a variety of learning applications. However, such systems will never become widely used because of their high cost, the technical complexity, the lack of software and the difficulty of software development. The column was positive about the potential and desirability of the micro/video combo, but was negative in its outlook with regard to future *widespread* application of such systems.

One reaction to my column appeared in an *InfoWorld* article, "Teclar Seeks Instructional Revolution" by Dennis Briskin (Jul 6 81). It tells about a newly formed company, Teclar Corp., Placerville, CA that develops interactive instructional programs for a system made up of an Apple II micro interfaced to a random access video tape player. The company has put together a practical low cost system and is apparently developing interactive learning programs for it. They felt my comments regarding the future and practicability of micro/video systems were too critical.

There is a key difference between the tape system Teclar supplies and the micro/video disk combination I focused on. It is relatively fast, cheap and easy to develop video *tape* learning programs with the hardware and techniques available. But transferring that program to a disk is a bit tricky. It is extremely expensive to tool up for a disk—and usually the prices will be impractically high unless you have high volume. Programming the disk for interaction is also complex and expensive. Finally, there are very few sources for disk duplication services. The facilities are already in full use just trying to meet the demand for the movie disks that are essential to the sales of both the Magnavox laser system and RCA's CED system. Unless an organization has the volume and the money and a worthwhile application, the micro/video disk combo is not what I'd call your practical, down-to-earth everyday learning system—at least not yet. You won't see such systems in the home or even in schools, but you will see them in military and industrial applications.

Computer literacy

Dr. Ed Martino, a teacher and computer consultant, wrote recently about a computer literacy class for teachers that he conducts at Nova University in Fort Lauderdale, FL. Apparently my June, 1981 column generated a lot of discussion and several extra credit responses. Since these responses come from teachers in the field either using or planning to use micros, I feel they are particularly important. While I don't have space to cove' 'hem all, here are a few excerpts that give a perspective o. ›se who will actually use micros in their work:

"Science teachers are using computers in many applications of discipline. . . Computers can be an effective learning and teaching tool in the classroom. Computer systems provide an individual approach to learning that can be used to maximize the potential learning experiences for slow as well as gifted students."

Douglas S. McDermott

"Since I am a guidance counselor in a large middle school, I would like to see a microcomputer taking over much of the time-consuming work that keeps us from counseling . . . a microcomputer could, hopefully, save many working hours that are now spent researching and verifying data."

Ms. Robin Rosen

"As a senior high school teacher of the educable mentally retarded, I believe that microcomputers can be a wonderful tool for the Exceptional Ed. teacher to use."

Ms. Tracy Barrack

"Microcomputers are having a definite impact on education. They are well-suited to meet the needs of elementary school teachers. The needs of elementary school teachers are diverse because they deal with all subject areas—not just one or two. . . In conclusion, microcomputers can enhance learning and assist teachers in many ways: computer-assisted instruction, word processing, simulation games, graphics and record keeping."

Ms. Christie Lis

"However, on the other side of the coin, we have a very good argument to support the use of microcomputers in the classrooms. . . I know several administrators who are taking courses and encouraging their staff to take courses, so that they can integrate computer education into their present curriculum."

Eva Dolores Samms

Incidentally, I think Dr. Martino has a very practical approach to teaching micros. He encourages teachers to think in terms of how the micro can be used in the regular curriculum in addition to the special computer awareness and literacy programs. But it is Dr. Martino's approach to programming that is interesting. He essentially discourages teachers from trying to program their own software. His theory is that most can't or won't learn to program. But with available software, this should not keep teachers from using micros. (Dr. Martino expressed his views on programming in his article "Don't Start With Programming" in the November 10, 1980 issue of *InfoWorld.*)

Computer music education

Teachers of music are apparently finding micros to be a real help. There is a considerable amount of activity going on around the country in developing computer-based music learning programs. There are several sources of information on this subject that music educators may want to look into.

Cecil H. Pretty of Eugene, OR sends a list of computer music education resources. He recommends that those attempting to develop programs contact the following: Richard Shirey or Virgil Hicks, Music Education Div., School of Music, U. of Akron, Akron, OH 44325; National Consortium for Computer Based Music Instruction (NCCBMI), Computing Centre, Western Washington U., Bellingham, WA 98225; and Minnesota Educational Computing Consortium (MECC), 2520 Broadway Dr., St. Paul, MN 55113.□

Some useful tax programs

Both this and next month's columns will focus on several useful programs that are ready just in time for the upcoming tax season. With these programs, it will not only be possible to prepare those complicated tax forms, but also to plan several "what-if" strategies to minimize income taxes. Although the programs are of most interest to the professional tax advisor, many tax-conscious individuals will find them informative and useful.

The first program, Howardsoft, is a tax preparation aid for the Apple computer by Howard Software, La Jolla, CA. The program retails for about $150 and includes a complete package to prepare the federal tax return and most of the ancillary schedules. The program requires at least 48K to run effectively, although only one disk drive is required. The user can employ either DOS 3.2 or 3.3, and 13 or 16 sector disks. (The program is supplied with 13 sector disks.)

At this writing, Howard Software is almost ready to issue programs to calculate state taxes for California, New York, New Jersey and Illinois. Perhaps other states will be added.

The programs were written by a doctorate engineer with an interest in investments and a good understanding of the tax law. The programs were intended to be used by the local CPA firm to prepare tax returns for clients—the return could conceivably be run during the client interview. The software can also be used for tax planning by entering the data, viewing the result on the screen instead of printing it out, then making changes in the data for alternative calculations.

There is no comparison to hand calculating taxes; the computer programs are a quantum leap forward in convenience, accuracy and versatility. The programs allow calculations in whole dollars or pennies, and can be integrated with the preparation of some forms by hand.

To begin the use of the software, a menu appears containing six modes to choose from, including: Mode 1—in which the system displays any updates or corrections that don't appear in the manual; Mode 2—same as mode 1, except that the updates are printed on the system printer; Mode 3—prepares storage disks (formats them); Mode 4—the tax preparation mode (main mode); and Mode 5—printing out the tax forms.

The "feel" of the program is similar to preparing a return by hand. One generally starts with the main form (the infamous 1040) and goes right on down each line item. When the preparer comes to a line that requires some detail calculations, such as the interest income or dividend income line, he prepares a separate schedule. Sometimes, the preparer may even desire to make up a separate detail schedule supporting the schedule that supports the one figure ending up on the 1040.

The tax program follows the same line of logic in the preparation of the return. When the user selects mode 4, a menu is displayed containing a listing of most of the schedules for the federal tax return. The intelligent way to proceed is to start with the 1040 form itself, entering the information until you get to a point at which a supplementary schedule is needed. The user then saves the data accumulated so far and exits back to the main menu, choosing the appropriate form to fill in. The menu consists of the following:

Instructions	Schedule 2106
Form 1040	Schedule 3468
Schedule A	Schedule 4562
Schedule B	Schedule 4726
Schedule C	Schedule 4797
Schedule D	Schedule 5695
Schedule E	Schedule 2210
Schedule F	Save last Dollars
Schedule G	Print out forms
Schedule R & RP	Restart Program
Schedule SE	End Program
Schedule TC	

The new version will contain three additional schedules, #2119 (sale of principal residence), #4625 (minimum tax on tax preference items) and #6251 (alternative minimum tax computation). You'll note that on the menu there is no indication as to what the various forms are for. The company assumes that the user is sophisticated enough to know what they are or how to look them up.

The programs are not designed to provide a working knowledge of the tax law or any of its loopholes. The programmers assumed that the user was fairly familiar with the process of preparing income taxes, and also that the preparer had a good grasp of the forms that comprise most tax returns. Even though I am a CPA, since I do not specialize in taxes, there were a few of the forms indicated above that I had to look up to know what they were for. The instruction manual does *not* contain any explanation of the forms, nor does it contain any explanation of the ins and outs of the tax law.

Custom back-up possible

The programs contain some very useful functions. One is the ability to create detail schedules at the user's specification. Most income tax preparation programs and commercial time sharing or service bureau tax return services do not have this feature—it's back to the old pencil and paper. With these programs, this is not necessary—or at least the need is greatly reduced. The user can, for almost any line item for any of the schedules or the main 1040, jump to the option that allows the creation of a custom back-up schedule. Thus it is possible to completely computerize the preparation of the return.

Another nice aspect of the Howardsoft programs is the ability to create files that can be updated or changed later. This allows, for example, for the CPA to begin the preparation of a client's return without having to complete it. The typical case is, of course, for the client who makes an appointment and comes in with all of the supporting documentation, except for one critical element, without which the return cannot be prepared. With this program, the preparer can proceed without the last critical piece of data. It can be added in when available. The storage mode also allows the programs to be used as tax planning tools. An initial set of assumptions can be entered and run; then alterations to the stored data can be made and the results observed.

The programs contain features that allow the accountant to use the system to maintain a data base for each client. As information comes to his attention during the year, it can be entered into the system, and the appropriate records updated.

Once all the information is in and the taxes are calculated, the forms can be scanned on the terminal. Then, at some point, it's time to prepare the hard-copy. The programs are designed to print on the standard 1040 form. These may be obtained

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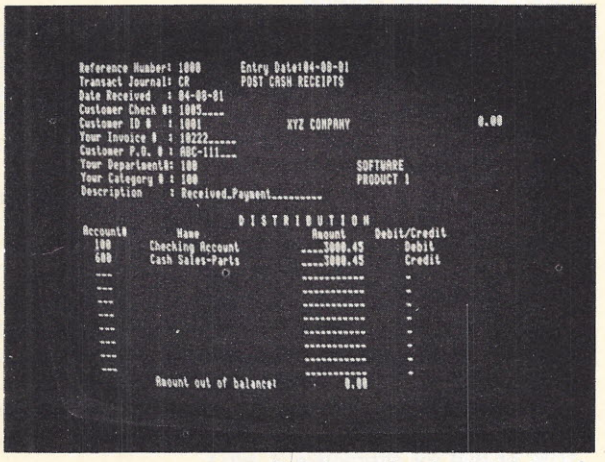

Typical screen format - actual photograph.

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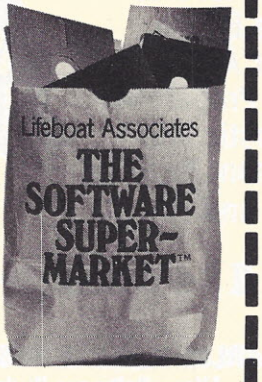

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from the company or ordered from independent distributors. If you prefer, you can have the 1040 form printed out. Now the IRS refuses to accept a 1040 form that isn't at least on a photocopy of it's form. So if you print out the 1040 form itself, you'll have to manually transfer the figures to the official form. In most cases, it's a safe bet that the user would want to print out the information on the official form 1040.

When it comes to the tax return schedules, the program prepares a computer generated form—i.e. it does not print out on the official form. That's no great sacrifice, since the forms are easier to follow than the official ones. In addition to the schedules that are an integral part of the return, the user has the option of printing out all of the supporting schedules that he has prepared. They can be printed out as either support to the tax return, or optionally as additional support for the taxpayer's files.

For the CPA or other professional tax preparer, the program may provide a unique and cost effective way of streamlining the tax preparation procedure. In the right hands, the program could be used during the client interview, with the tax return generated at the conclusion of the interview. That would be a real time saver. On the negative side, Howardsoft's tax program assumes that the user has a working knowledge of the tax law and the principal forms used to prepare the returns. Also, the professional should not be lulled into thinking that the program covers every tax situation—to the contrary. Especially in the area of penalties, there are some situations, such as underpayment penalties that might be overlooked if the preparer is not alert. Thus, the program is not for the novice. As to computer knowledge required to run the programs, none is necessary. About all a user has to know is how to put the disk in the drive and turn on the computer and the printer.

One of the more impressive sets of software that we have reviewed in this column, the individual Tax Planner from Aardvark Software, Milwaukee, WI, is designed to run on the Apple computer that has at least 48K of memory, one or more disk drives and DOS 3.3 or the Pascal language system.

The tax planner is exactly what its name implies—it is a system that allows the user to perform a number of alternative tax calculations to determine what the federal tax liability will be under different assumptions. The program was written by a group of CPAs with over 17 years of experience. (In other words, they understand taxation and what the average tax practitioner needs.) From a review of their programs, they also understand computers and how to put together a professional, easy-to-use and powerful set of software.

The software answers a real need among accountants for a simple but powerful product to provide analyses of alternative tax computations. The software will make computations of federal tax liability, add-on minimum and alternative minimum tax, ten year averaging of lump-sum distributions, limitations and carryovers of capital loss, charitable contributions and medical expenses. It allows the user to immediately see the tax effects of changes in income or expense items, and display the results or print them out (in a form suitable for presentation to clients). The software also has provisions that allow the user to save information for later changes or review.

Illustrations are helpful

The manual is well put together, with numerous illustrations of what the screen should look like, and a guided tour through the basics of using the system. There are two detailed illustrations that give the novice user a good understanding of how the system works. Testing the system to do a simple tax plan, it performed very well.

The best part of the software is the data entry sequence. It's organized so that you go "down the line" on the typical 1040. At each question, the user is prompted to fill in up to five alternative values for the taxpayer and his spouse. There are a lot of little aids that the program contains to make the data entry sequence easier. For example, it is possible to enter just one figure for up to five alternatives, then skip to the next line item. It's also possible to make an entry, then increase it by a percentage for the other alternatives (i.e. increase a $25,000 wage by 10% for alternative 2, then 10% of that for alternative 3, etc.).

The program contains 72 line items that can be entered. That sounds like a lot, but you'll usually use far fewer. The program has an easy method of skipping from one to another. In fact, they allow the user to go back and forth and change items at will. The entry sequence is easy to learn and comfortable from a user standpoint.

One of the best aspects of the system is the organization of the manual. It contains a short summary section that basically contains all necessary information for the user to know to run the system, and a whole set of sample forms that allow the user to gather information in the order that the system will request it. There are four pages of forms that may be easily reproduced on an office copier.

Once the information is entered, the system calculates the taxes. The user can then view the results on the terminal or have the system printer print a report. The terminal will display up to two alternative calculations. The system printer will generate a report of up to four on a page. The analysis generally fits on one page. The useful feature of both the printing program and the terminal display program is that the operator can specify which of the alternatives is to be presented. Thus it becomes practical to run perhaps five alternatives, choose three that appear most reasonable, then print out those on a written report to the client. The user can then re-access the data file, input alternative numbers and re-run the entire system.

The system provides outstanding software for the professional accountant who wants to be able to give on-line answers to the most common questions of tax planning, enabling an impressive and meaningful tax planning session. The system could justify the purchase of an Apple, particularly if a tax preparations program is also purchased. □

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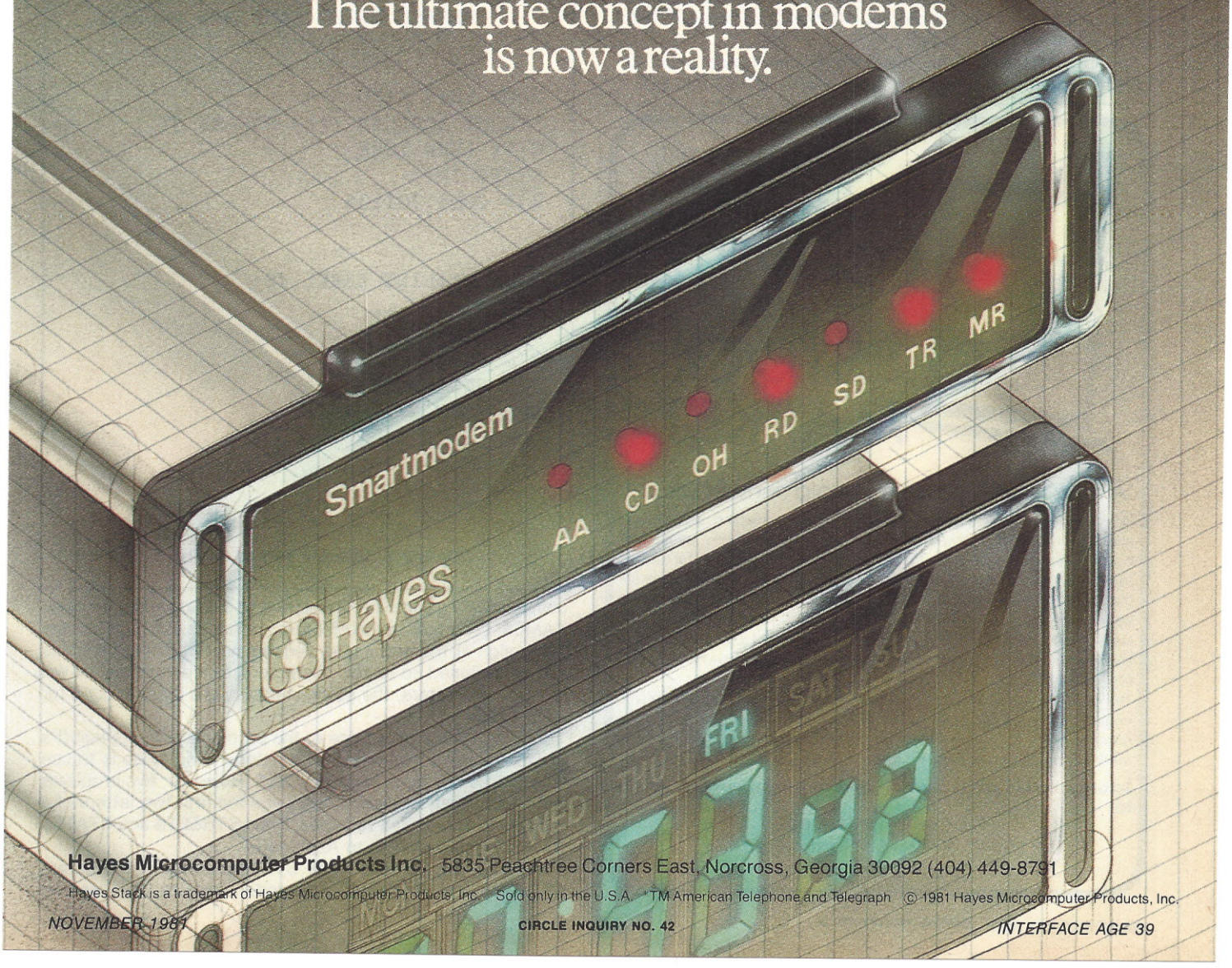

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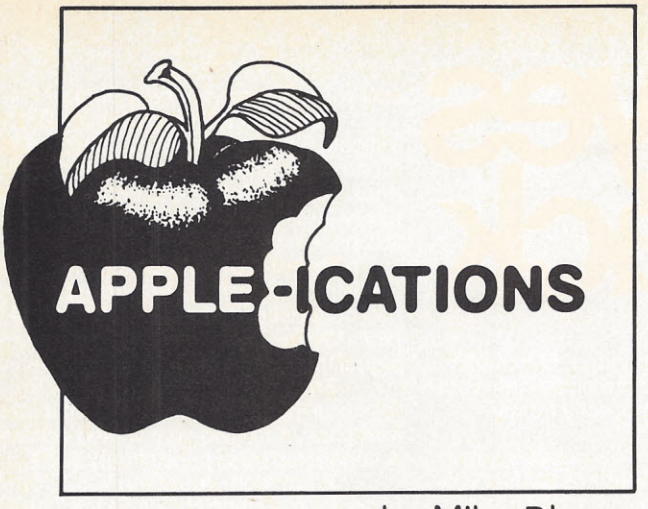

by Mike Dhuey

Some Basics of Applesoft Basic

Once you've done your VisiCalc models and played Adventure and Space Invaders, it's time to start writing your own programs. Using Applesoft and DOS (Disk Operating System), you can start programming your Apple II to organize information to your exact needs—something canned programs never quite accomplish.

Programs that deal with information have three basic components: the gathering, storing and retrieving of information. With the Apple II, information can be entered from the keyboard, the game controllers, the disk or any peripherals plugged into the slots. Once that information is entered, it is generally stored on the disk.

In Applesoft Basic, there are three commands used to enter information into the computer—GET, INPUT and PDL.

GET and INPUT are generally used for keyboard input; however, input from devices in the slots can also be done with these commands. PDL is used exclusively to input the setting of the game controllers.

Displaying information on the screen is generally done by the PRINT command. PRINT is also used to send information to devices in the slots such as printers.

These same commands are used to store and retrieve information from the disk. But the disk commands precede the GET, INPUT and PRINT commands so that the disk is accessed instead of the keyboard or screen. The simplest form of entering information is using the INPUT command. Let's develop a program to input the name and address of someone and save it in the computer. Listing 1 illustrates our first attempt.

Cursor at top left

The program begins at line 1000 with a HOME command, which clears the screen and puts the cursor (the location where the next character will be printed) at the top left corner of the screen. The next line is a PRINT command, which titles the screen. The next two lines are null PRINT commands; each will cause the cursor to move to the left of the screen and down one line. At line 1040, the first prompt for user input occurs. The PRINT command ends with a semi-colon, indicating that the cursor should not go to the next line. This is to keep the question mark that the INPUT command will print on the same line as the NAME prompt. The INPUT

```
]RUN
      PLEASE ENTER NAME AND ADDRESS


NAME ?BIG BIRD
STREET ADDRESS ?123 SESAME ST
CITY ?NEW YORK
STATE ?NY
ZIP CODE ?01234


YOUR MAILING LABEL IS:


BIG BIRD
123 SESAME ST
NEW YORK NY  01234

]
```

Figure 1. Sample run of listing 1

command will assign the characters to a string variable called NAME$. (The fact that NAME$ is a string is indicated by the dollar sign at the end of the variable name.) String variables can be assigned up to 255 characters. Since most names will fit in 24 characters, the string variables are large enough for most uses.

Line 1110 points out one of the problems with Applesoft's variable name conventions. The natural thing to do is to use STATE$ as the name instead of S2$. However, two problems will occur. First, Applesoft only uses the first two letters of a variable to distinguish variables. Thus STREET$ and STATE$ are the same variables to Applesoft.

Second, the variable name STATE$ contains the letters AT, which is an Applesoft command. If you use "AT" as part

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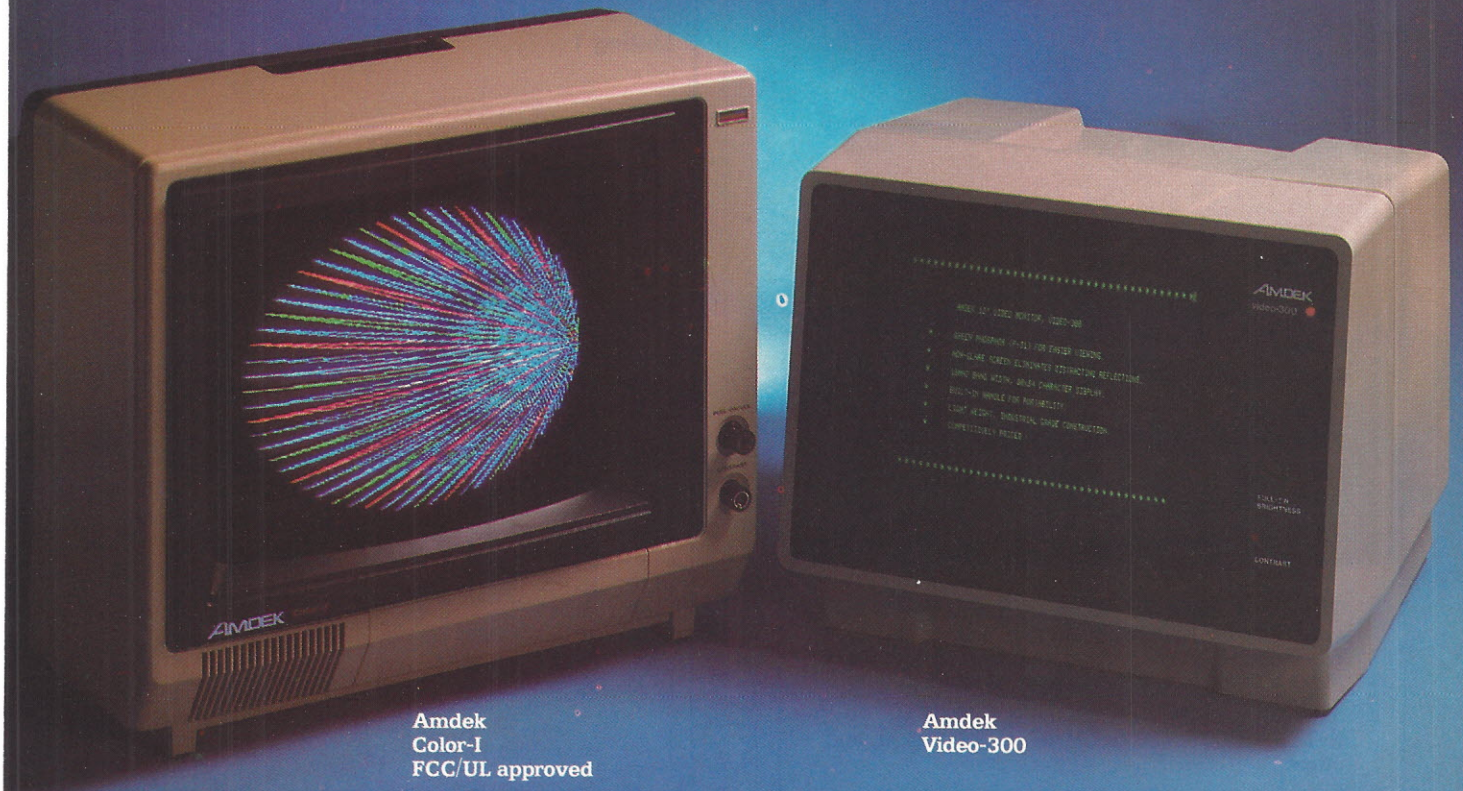

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of the variable, the program will try to use it like a command. Thus it is always a good idea to list a program after it is typed in to see if Applesoft interprets your variable names as commands instead of names. Finally, line 1210 shows how more than one variable can be combined on a line to format the correct city-state-zip code sequence.

This program shows some of the basics of programming, but it really isn't as functional as we might like. A list of improvements would include: 1) if a mistake was made on a previous input line, we might want a way to return to that line and make a correction; 2) since our mail label will probably only allow for a fixed number of characters, it would be desirable to indicate to the user how many letters are allowed at each input; 3) since we lose the data each time we finish the program, we need a way to save the label information on the disk where we can retrieve it at some future time; 4) since we can't send chunks of the screen in the mail, we should optionally send the labels to a printer.

Listing 1

```
1000  HOME
1010  PRINT "      PLEASE ENTER NAME AND ADDRESS"
1020  PRINT
1030  PRINT
1040  PRINT "NAME ";
1050  INPUT NAME$
1060  PRINT "STREET ADDRESS ";
1070  INPUT STREET$
1080  PRINT "CITY ";
1090  INPUT CITY$
1100  PRINT "STATE ";
1110  INPUT S2$
1120  PRINT "ZIP CODE ";
1130  INPUT ZIPCODE$
1140  PRINT
1150  PRINT
1160  PRINT "YOUR MAILING LABEL IS:"
1170  PRINT
1180  PRINT
1190  PRINT NAME$
1200  PRINT STREET$
1210  PRINT CITY$" "S2$"  "ZIPCODE$

]
```

To address the first two improvements, the INPUT command can be discarded in favor of the GET command. This, however, introduces greater complexity since a GET command simply returns each keystroke as it is typed, instead of automatically handling the RETURN and left and right arrow keys.

Corrections are possible

Listing 2 improves the user interface at the expense of greater complexity in the program. The number of characters in an entry is now indicated by underscores and the user can correct errors on previous lines by pressing the escape key to go up one line.

Lines 1000 to 1030 create a variable UL$, which contains 32 underscore characters. Since the keyboard cannot generate this character, it is obvious to the user that this is the entry area of the screen. Line 1040 assigns a size to each of the array variables listed. Since the majority of the program is the same input routine, the arrays will allow the reuse of most of the code. Without arrays, this program would be five times larger.

The FIELD$ array contains the names of the fields. The SIZE$ array contains the number of characters in each field. The DA$ array contains the actual entries made by the user

for each field. Finally the SA$ array is a temporary array that stores each character of the user input separately. This is compressed in a DA$ array variable each time the next field is entered. Line 1050 assigns the various control characters (RETURN, right arrow, left arrow, and ESCape), which the keyboard generates to variables so a test can be made for each one. Lines 1060 through 1100 assign the names of the fields, and lines 1110 through 1150 assign the number of characters to be input for each field.

The input screen is cleared and the fields identified in lines 1200 through 1260. Presenting all fields at once allows the user a complete template to fill, so questions as to whether the city and state belong in the ADDRESS field or if the state is abbreviated are answered in a concise manner.

The main entry loop starts at 1300 and continues to 1690. Basically, this positions the cursor for the next input, performs a GET command, then determines if any control function keys or a normal keystroke are entered.

The first test is line 1330, where the keystroke is tested for the RETURN key. If it is the RETURN key, the individual characters entered for this field are collected into the appropriate DA$ array element, and the next fields' DA$ element is spread out into individual characters. If this is the last line, the mail label is printed. Otherwise, the input for the next line is begun.

The next test is for the ESCape character, which is used to go up the screen instead of down. This allows editing previous lines of input. Finally, the tests for left and right arrow are made and the cursor is positioned accordingly.

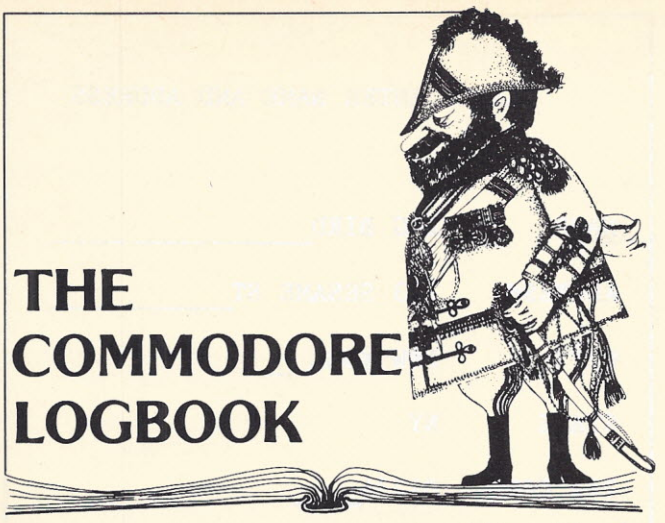
If none of the control functions are pressed, the keystroke must be actual data, and line 1660 displays the character and stores it in the SA$ array. Again the last step of the program formats the data into a mail label.

Now that we have a nice user interface to gather information with, the next step is to save this information to the disk. Next month's column will address this issue. □

```
PLEASE ENTER NAME AND ADDRESS

NAME        BIG BIRD_____________
ADDRESS     123 SESAME ST_______
CITY        NEW YORK____
STATE       NY
ZIP CODE    01234____

      YOUR MAILING LABEL IS:

BIG BIRD
123 SESAME ST
NEW YORK NY  01234
```

Figure 2. Sample run of listing 2

Listing on page 150



THE COMMODORE LOGBOOK

by Mike Heck

Controlling the Purse Strings

Theodor of California (Gardena, CA) is a leading manufacturer of handbags, distributing coast-to-coast. The company employs about 200 production people and is engaged in manufacturing a product that has a high labor content, yields a low profit margin and is seriously threatened by foreign competition. In a search for greater efficiency, the company hired the management consulting firm of Victor Ardon and Associates (Beverly Hills, CA), who specialize in helping clients, usually manufacturing plants, reduce costs and improve efficiency. Ardon has found that the use of microcomputers is one of the most cost effective tools available.

In 1978, Ardon installed the first Pet computer at Theodor to help the company estimate the cost of manufacturing a particular style of bag. Since that time, Ardon has incorporated two more systems into Theodor—one to create tickets, used in the incentive program, and one to manage the warehousing of the merchandise.

Producing handbag styles that sell involves keeping pace with the whims of the fashion world. New styles are brought into the line at least four times a year. Although there may be no more than 30 bag styles in one line, it may be necessary to cost out 100 styles before putting a line into production.

Costing, the art of estimating all the manufacturing costs of an item before it is produced, involves determining both material and labor expenditures. Traditionally, this is done by sitting down and producing a copy of the item. The first step in determining material cost of a particular bag is collecting and inputting the unit material costs (e.g., price per yard of fabric or clasp prices). Information about both material and labor costs need not be entered for every costing; once the information is entered into the computer, it remains stored for future use and can be periodically adjusted using an inflation factor.

The computer asks for the dimensions of each piece that will be used, adds an appropriate scrap factor, makes any adjustments, then calculates each component's costs. When all material costs are in, the computer provides several subtotals, giving a breakdown for each type of material, as well as a total for all material costs.

Labor is calculated differently. A list of all possible operations necessary to produce any type of bag and the time each operation requires is stored on disk. In order to determine "ideal" labor cost, the computer uses this standard data in selecting the operations that apply to a given style and add up labor costs. This ideal figure is then factored by an effective performance rating of any given department to obtain a realistic reflection of the anticipated actual labor costs. If the style is totally new, a "learning curve" factor can also be added.

The computer can also add any extraordinary costs, such as overhead and indirect labor. Ardon estimates that this costing method is four times as fast as the previously used manual system. The present costing is so much more efficient that many more samples are being costed out. As such, when costs are a little high for a given item, the design can be easily modified on paper until the right combination is found.

The plant is run on an incentive system: workers get paid according to the amount of work they do. In the past, as an operator finished each procedure, he would record an entry into his daily production log. The three clerks responsible for collecting this information were always swamped, as were the supervisors, who were called upon whenever there was a disagreement between worker and clerk. Much of this confusion was eliminated by installing a ticket system. This involves providing the worker with a paper ticket at the time the task is completed. These tickets, which provide a clear record of each day's production, can be kept by the worker as proof of his daily effort.

Conventional ticket systems used by most garment manufacturers involve the use of special ticket machines and special ticket stock. Theodor uses a Commodore computer, disk drive and printer in place of the conventional equipment. Over 4,000 tickets are printed each day. No special ticket stock is required, because tickets are printed on the same mailing label sheets commonly used for addressing. Each ticket carries information identifying the operation and bag style and data regarding the time alloted to the job and the amount of pieces per hour designed for the operation. These tickets travel with the work.

Upon completion of the job, the operator peels off the label and pastes it on a structured ticket sheet (also produced by the computer) bearing the name of the operator. This sheet acts as the operator's reporting form. The data from the ticket sheet is manually entered into the computer at the end of the day. Calculations to arrive at both percent performance for each operator, as well as earned time, are performed automatically by the computer. Each individual's daily performance is printed and posted in the plant.

Theodor uses the third Commodore system to manage its warehouse. With the aid of this computer, the company has increased its manufacturing production to such an extent that it began to run out of warehouse space. A close examination of the warehouse revealed that much space was wasted through inefficient allocation.

Each style of bag was allocated enough space to hold a full stock of that particular bag. But at any one time, few of these storage areas were completely full. By allowing the computer to allocate space as needed, rather than providing the maximum space for each bag, the problem of under-utilized storage space was solved.

Specific areas are no longer permanently allocated to particular styles. Instead, any bin of any rack can take any style of any color bag. This is possible because when a load is brought from the factory, the computer directs the loader where to put the stock. The computer then keeps track of where each load is placed, in addition to which areas remain open. The system also directs placement, so that all bins of one particular style are located as close as possible.

When it comes time to pick up an order, the computer directs the operator to the closest bay containing an adequate quantity of bags in the desired style. As an added benefit, since the computer is keeping track of all this information, an accurate, up-to-date inventory is always maintained. Users can get a printed record of inventory at any time.

Program for the Vic 20

Since the Commodore Vic 20 is a very powerful computer in its own right, it can be put to work on many business applications. Although it is not within the scope of this column to teach programming, the accompanying program demonstrates the use of the Vic to do some real calculations applicable in any business.

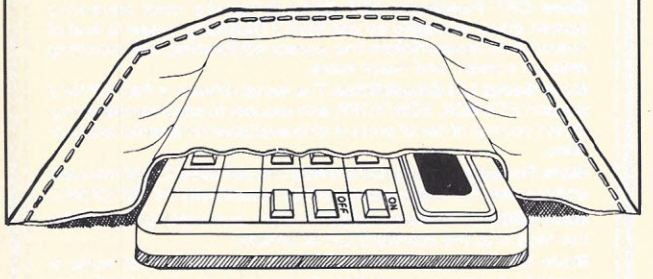
The following program will calculate salvage value based on the original price, number of years and rate entered. Type the program in as shown and run it. To make the program more useful, it will ask if you want to see what the salvage value will be for other years using the same data. The actual formula that does the calculation is a single line (90). The remainder of the program accepts the data and performs other formatting and logic. From time to time, small programs that do different business calculations will be presented here so you can collect a library of helpful routines.□

Listing

```
READY.

 10 REM SALVAGE VALUE PROGRAM
 15 PRINT CHR$(147)
 20 PRINT"      SALVAGE VALUE"
 25 FOR X=1 TO 22:PRINT "-";:NEXT
 26 PRINT
 30 PRINT:PRINT"ENTER ORIGINAL PRICE"
 35 INPUT P
 40 PRINT"ENTER DEPRECIATION RATE "
 45 INPUT DEPRATE
 49 PRINT
 50 PRINT" (ENTER YEARS=0 WHEN NO"
 60 PRINT" MORE VALUES NEEDED.)"
 69 PRINT
 70 PRINT"ENTER # OF YEARS "
 75 INPUT YEARS
 80 IF YEARS=0 THEN 120
 90 PRINT"VALUE = $";INT(100*P*
    (1-DEPRATE/100)^YEARS+.5)/100
100 PRINT
110 GOTO 70
120 PRINT"MORE DATA (Y/N) ";
125 INPUT INPT$
130 IF INPT$ = "Y" THEN 15
140 END
```

POWER IN YOUR POCKET

by Bob McElwain



The Sharp PC Printer

The Sharp Pocket Computer (PC-1211) is now available in computer stores and most places that handle Sharp calculators. This is the same unit Sharp manufactures for the Radio Shack TRS-80 PC. Only the dealer labels are different. The suggested retail price for either unit is $249. Since the Sharp model is carried by independent shops, you may be able to find modest discounts.

Two features of Sharp's model should be mentioned. The unit comes with a hard plastic carrying case that should protect it better than the soft case of the TRS-80. Beyond the 90 day warranty, Sharp will repair a computer for a standard rate of $45, or replace it if it can't be repaired.

Documentation includes a manual, a set of 125 programs and a beginner's guide to programming in Basic. The manual, like Radio Shack's, is not a good tool for the beginner. The set of programs, however, will be helpful. The programs include topics from engineering, mathematics, statistical analysis and business.

The Sharp computer has 1,424 bytes of memory that can be used for program or variables, with additional memory reserved for 26 variables. The language is Basic, a simple subset of what's usual on larger computers. The 24 character dot matrix display provides for input and output, one line at a time. Program lines can be 80 characters long. Full cursor control allows scrolling up or down and left or right, with edit capability. The right portion of program statements longer than 24 characters is displayed by moving the cursor to the right.

The computer will run for 300 hours on a set of inexpensive batteries. Programs and data remain intact when the computer is switched off. Battery operated and weighing only six ounces, it can literally be slipped into your pocket.

The big news is that Sharp and Radio Shack both have a printer now. It's manufactured by Sharp and features the Epson unit, used so successfully with Sharp's calculator line. The printer outputs 16 characters to a line, 60 lines a minute, printing a single row of dots at a time. It uses standard size rolls of plain paper, $1\frac{25}{32}$ inches wide.

When printing or listing a program, output is continued to additional lines as needed. Even though the lines are short, the tape is easy to read. The unit is powered with a rechargeable Ni-Cad battery. Unfortunately, the battery is not user replaceable.

The printer unit includes a cassette interface. The computer slips into the printer unit as it does into the cassette interface. (If you own an interface and buy the printer, you can do as I did; toss out the old interface. Chances of resale aren't high.) It'll take a big pocket to handle the computer connected to the printer unit, but the combination is still extremely portable. From Sharp or Radio Shack, the price of the printer unit with cassette interface is $150.

Incidentally, Sharp also has a cassette interface, priced at $50. But think carefully before buying the interface alone. If you can use a printer, it's only $100 more. If you buy the cassette interface, then later buy the printer unit, you'll have lost $50.

For the printer unit, Sharp has a convenient carrying case. At this writing, Radio Shack does not. Radio Shack's ribbon cartridge uses black ink, while Sharp's uses a violet color. The black may be a bit easier to read. The cartridges are interchangable.

I suspect the Sharp PC-1211 is only a beginning. I'm looking for much more in handheld computers from Sharp.

Inventory estimate program

Let's consider a practical application for a pocket computer. As an example of what can be done effectively, we'll develop a program that can be used to find the real cost of inventory purchased. It's a simple, straightforward approach that can provide the solid information needed for good judgment. If you'd like a more detailed development than the abbreviated form included here, send me a stamped, self-addressed envelope with your request c/o the magazine. I'll forward a copy.

We'll begin by building a formula. Here are the variables used.

- C = Cost per unit of inventory
- D = Discount rate to be exercised
- F = Total freight-in
- K = Monthly cost per linear foot of shelf length
- L = Estimated length of shelf, in feet, required to store/display this inventory
- M = Number of months to sale of last item
- P = Percent of waste expected
- Q = Quantity purchased
- R = Monthly rate for money borrowed or interest lost on capital
- S = Estimated number of sales per month
- T = Total cost of this inventory purchase

The initial cost per unit, C, must first be decreased by the amount of any discount to be taken. The discounted cost is C – C*D. The number of months to last sale, M, can be computed from an estimate of sales per month, S: M = Q/S.

A formula can be developed by combining the following. The total initial discounted cost is

C*Q (A)

A monthly interest rate of R, as a decimal fraction, charged for the quantity on hand at the end of each month, accumulated over M – 1 months, gives a total interest cost of

C*R*Q*(M – 1)/2 (B)

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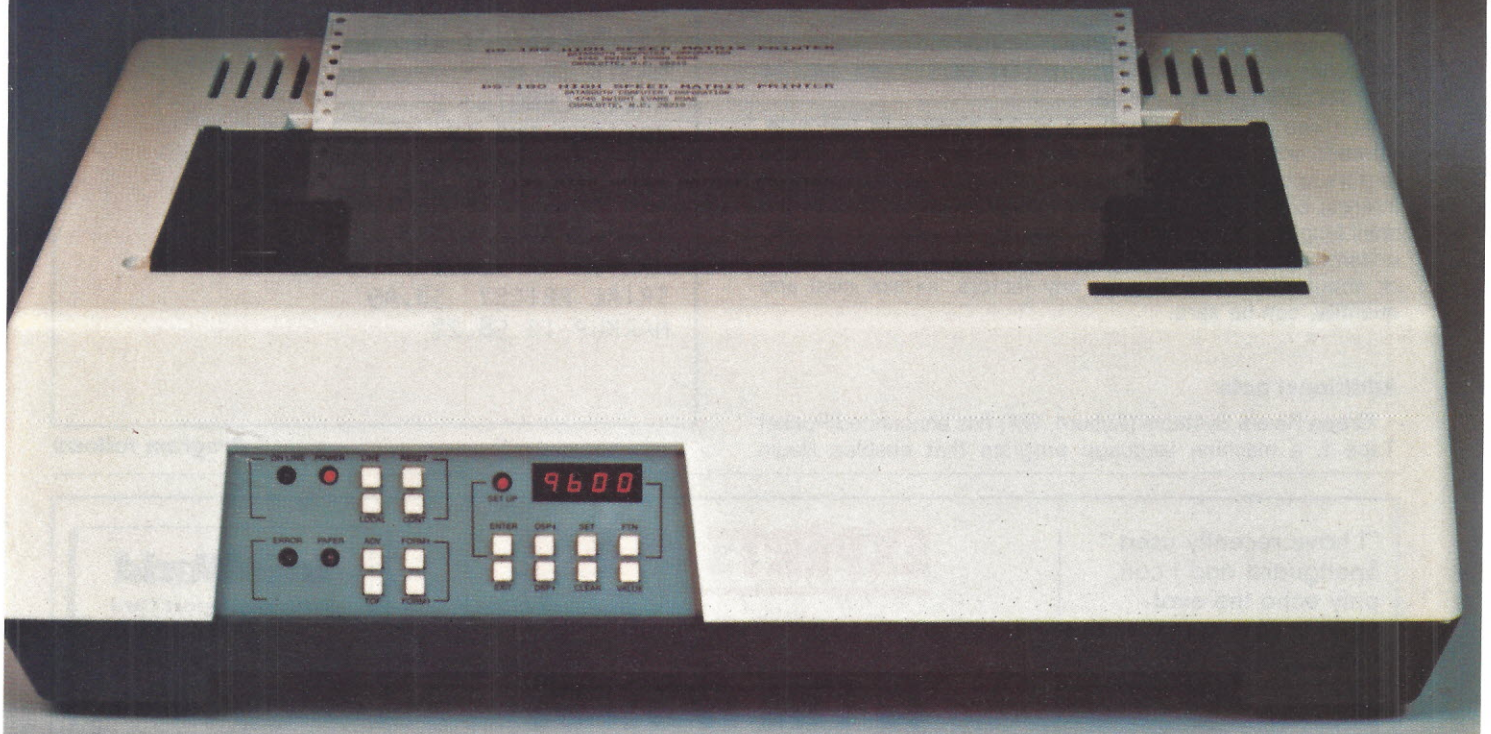

With so many matrix printers on the market today, it may seem tough to find exactly the right one for your application. Some models may offer the speed you need, others the communications flexibility and still others the forms handling capability. But no printer offers **all** the features you need...until now.

The DS180 matrix printer provides the total package of performance features and reliability required for applications such as CRT slave copy, remote terminal networks and small to mid-range systems. Not a "hobby-grade" printer, the DS180 is a real workhorse designed to handle your most demanding printer requirements. And pricing on the DS180 is hundreds of dollars below competitive units.

High Speed Printing—Bidirectional, logic-seeking printing at 180 cps offers throughput of over 200 lpm on average text. A 9-wire printhead life-tested at 650 million characters generates a 9x7 matrix with true lower case descenders and underlining.

Non-volatile Format Retention—a unique programming keypad featuring a non-volatile memory allows the user to configure the DS180 for virtually any application. Top of form, horizontal and vertical tabs, perforation skipover, communications parameters and many other features may be programmed and stored from the keypad.When your system is powered down, the format is retained in memory. The DS180 even remembers the line where you stopped printing. There is no need to reset the top of form, margins, baud rate, etc....it's all stored in the memory. If you need to reconfigure for another application, simply load a new format into the memory.

Communications Versatility—The DS180 offers three interfaces including RS232, current loop and 8-bit parallel. Baud rates from 110-9600 may be selected. A 1K buffer and X-on, X-off handshaking ensure optimum throughput.

Forms Handling Flexibility—Adjustable tractors accommodate forms from 3"-15". The adjustable head can print 6-part forms crisply and clearly making the DS180 ideal for printing multipart invoices and shipping documents. Forms can be fed from the front or the bottom.

If you would like more information on how the DS180's low-cost total printer package can fill your application, give us a call at Datasouth. The DS180 is available for 30-day delivery from our sales/service distributors throughout the U.S.

CIRCLE INQUIRY NO. 28

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Some items demand use of a waste factor for breakage or spoilage. If P is a percentage expected to be lost, as a decimal fraction, we have

P*C*Q (C)

There are many ways to compute warehouse costs. Here I've assumed an estimated monthly cost for a linear foot of shelf space, K, is available. Then the shelf cost is

L*K*M/2 (D)

Combining A, B, C and D above and adding in F, the cost of freight-in, gives

$$T = C*Q + C*R*Q*(M-1)/2 + P*C*Q + L*K*M/2 + F$$

which can be written as

$$T = C*Q*(1 + R*(M-1)/2 + P) + L*K*M/2 + F$$

The accompanying program is written in Basic for the Sharp or Radio Shack pocket computers. It should run with little modification on any computer with Basic available.

If expected sales are only three units per month, results will be (other factors held constant): TOT COST/UNIT $4.144 and STD SELL PRICE $7.02.

At three units per month, it is 24 months to last sale. Interest and shelf costs are significantly increased. These factors account for the increased cost. To see the effect of interest costs only, use the same data as above, but let the shelf length be zero. This will make shelf cost zero. For S = 10 units/month, I got $3.502 cost/unit. For S = 3, I got 3.977, or about 48¢ more. In use, any factors, except cost and quantity, can be zero.

Additional note

Green Rivers Systems (Auburn, WA) has announced Pocket Tape I, a machine language program that enables Radio Shack's TRS-80 models I and III to read/write cassette tapes that were written and can be read by the TRS-80 PC. The program allows the use of the pocket computer for input and output, while leaving the data processing to a larger system. It was not stated that programs can be moved, but I suspect they can be.

The program looks interesting. There's an additional hardware interface required for the model I. It should run fine on any model III with cassette or disk. □

Sample run

```
INVENT COST
COST/UNIT? 3
% OF DISCOUNT? 3
MONTHLY INT %? 2
QUANTITY? 70
EST SALES/MO? 10
WASTE %? 6
SHELF LENGTH? 2
FREIGHT-IN? 17
TOT COST/UNIT $3.552
STD SELL PRICE $6.02
TRIAL PRICE? 7.49
MARKUP IS 52.6%
TRIAL PRICE?  $8.49
MARKUP IS 58.2%
```

Program follows

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Penny wise and software foolish. One of the best ways to cheat your business is to waste a whole lot of time on solutions that don't work, or that can't grow with your business. And frankly, we get phone calls every day from computer users who've tried to get by on "bargain" software, and found that "bargain" software is the most expensive kind a business can own.

Here's a fact: if you have a real need for a computer in any of these areas:

General Ledger
Accounts Receivable
Accounts Payable
Order Entry
Inventory Control
Payroll,

any business software less than Structured Systems Financial Software is cheating your business. You'll cheat yourself out of lots of time. Time spent with systems which aren't designed for high volume use. You'll cheat yourself out of reliable audit controls and reliable error prevention features. Out of the training you invest in a system you outgrow when you need to add more disk storage, more customers, more data. You'll be cheating yourself out of a software bargain in the truest sense of the word—the greatest value for your dollar.

CP/M® microcomputer systems can do the job of minicomputers. Structured Systems software makes that potential a reality. Right now, hundreds of businesses are profiting from the financial controls and operating efficiency of SSG financial software. So can yours.

Take it easy on yourself. But sentence your computer to hard labor.

Please send more information on your

☐ General Ledger ☐ Accounts Receivable ☐ Order Entry
☐ Accounts Payable ☐ Payroll ☐ Inventory Control

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Company _____
Address _____
City State Zip _____
Telephone ( ) _____

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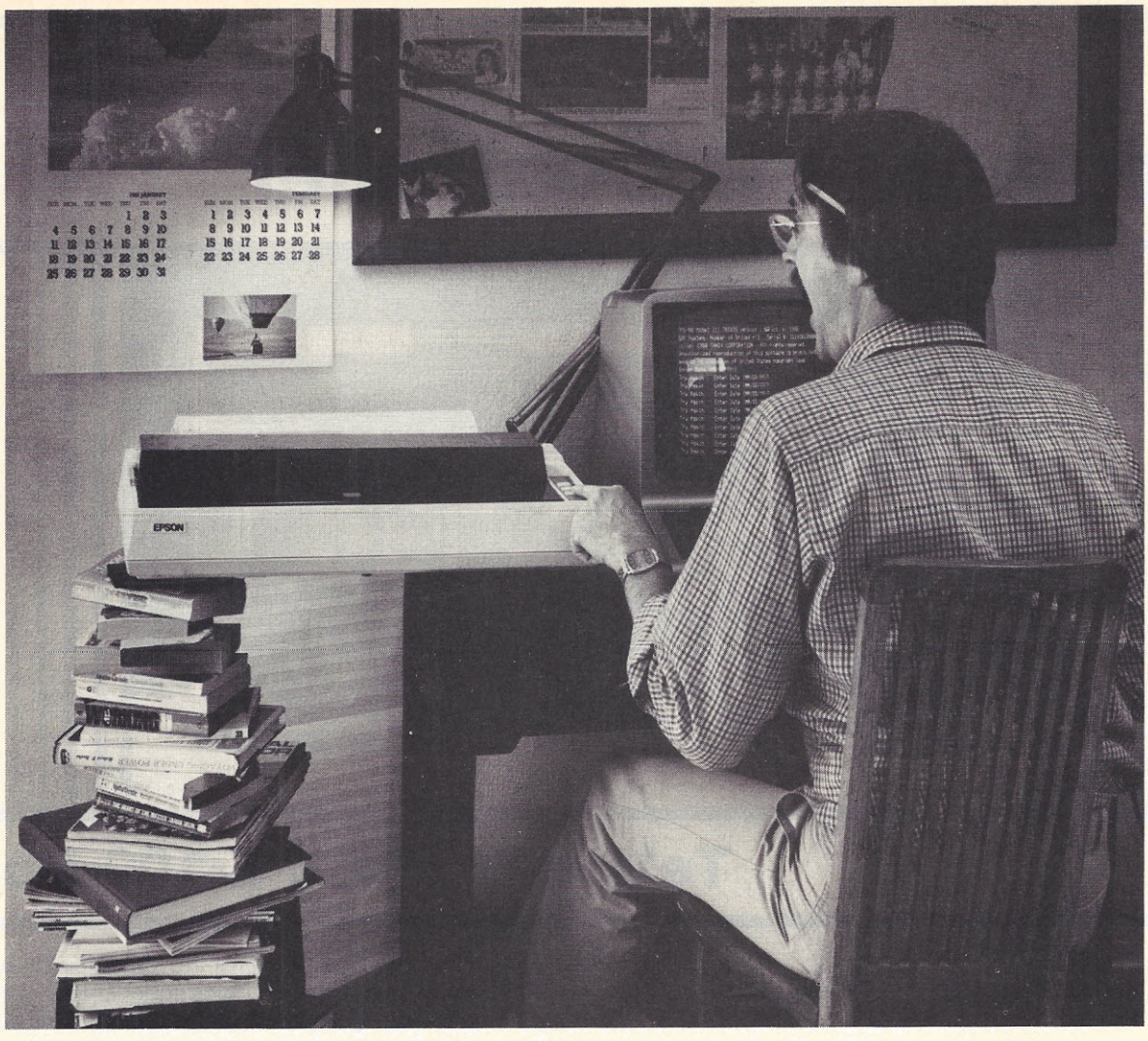
Structured Systems Group INCORPORATED

5204 Claremont, Oakland, California 94116 (415) 547 1567

Program listing

```
10: PRINT "INVENT COST"
    - Get initial cost per unit.
20: INPUT "COST/UNIT? ";C
    - Discount rate. Can be zero.
30: INPUT "% OF DISCOUNT? ";D
    - Convert to decimal.
40: D = D/100
    - Compute discounted cost/unit.
50: C = C-D*C
    - Monthly interest cost/loss.
60: INPUT "MONTHLY INT %? ";R
    - Convert to decimal.
70: R = R/100
    - Get quantity.
80: INPUT "QUANTITY? ";Q
    - Get expected sales.
90: INPUT "EST SALES/MO? ";S
    - Waste percentage.  Can be zero.
100: INPUT "WASTE %? ";P
    - Convert to decimal.
110: P = P/100
    - Estimated monthly shelf cost,
      per foot.  Change as needed.
120: K = .5
    - Get shelf length required.
130: INPUT "SHELF LENGTH? ";L
    - Get freight cost.
140: INPUT "FREIGHT-IN? ";F
    - Find months to last sale.
150: M = Q/S
    - Formula as derived above.
160: T = C*Q*(1+R*(M-1)/2+P)+L*K*M/2+F
    - Round off to nearest tenth of
      a cent.  For nearest cent,
      change both 1000's to 100.
170: Z = INT(T/Q*1000+.5)/1000
180: PRINT "TOT COST/UNIT $";Z
    - Here is a standard markup.
      Change as needed.
190: X = .41
    - Compute selling price from
      standard markup.
200: W = Z/(1-X)
    - Round to nearest cent.
210: W = INT(W*100+.5)/100
220: PRINT "STD SELL PRICE $";W
    - Consider other prices.
230: INPUT "TRIAL PRICE $";W
    - Compute markup this price.
240: X = (W-Z)/W
    - Round to nearest tenth percent.
250: X = INT(X*1000+.5)/10
260: PRINT "MARKUP IS ";X;"%"
    - BREAK to exit this routine.
270: GO TO 230
```



The MX-100. Not just better. Bigger.

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Our MX-80 was a pretty tough act to follow. I mean, how do you top the best-selling printer in the world?

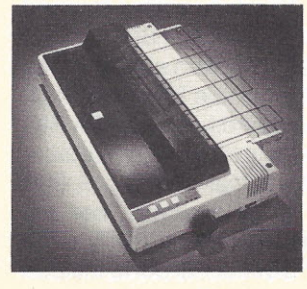
Frankly, it wasn't easy. But the results of all our sleepless nights will knock your socks off.

The MX-100 is a printer that must be seen to be believed. For starters, we built in unmatched correspondence quality printing, and an ultra-high resolution bit image graphics capability. Then we added the ability to print up to 233 columns of information on 15" wide paper to give you the most incredible spread sheets you're ever likely to see. Finally, we topped it all off with *both* a satin-smooth friction feed platen *and* fully adjustable, removable tractors. And the list of standard features goes on and on and on.

Needless to say, the specs on this machine — and especially at under $1000 — are practically unbelievable. But there's something about the MX-100 that goes far beyond just the specs; something about the way it all comes together, the attention to detail, the fit, the feel. Mere words fail us. But when you see an MX-100, you'll know what we mean.

All in all, the MX-100 is the most remarkable printer we've ever built. Which creates rather a large problem for those of us at Epson.

How are we going to top this?



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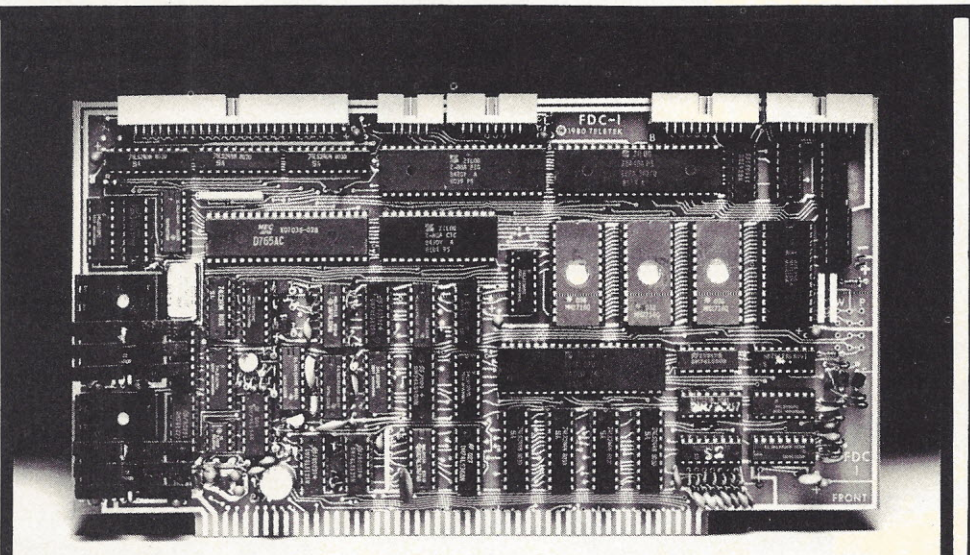

Teletek's FDC-I S-100 Board

by Roger H. Edelson

If your system is set up anything like the one I use, you probably have a CPU board, an I/O board, two to six memory boards and a disk controller. If you also have a monitor in residence (PROM/ROM storage) and a system clock, this will probably add two more boards. Another card slot can be taken up by a PROM programmer board, giving a total of approximately eight S-100 cards to form a complete working system. The FDC-I by Teletek, Sacramento, CA, manages to pack most of the above functions on a single well designed, nicely constructed S-100 compatible board.

Drawing only 1.5 amps from the 8-volt power supply and about 50 mA each from the +16 and −16 volt supplies, the unit is a full microcomputer on a board. The card is designed to meet the specifications of the almost issued IEEE S-100 bus standard. For industrial users, it's nice to know that the workmanship conforms to the requirements of MIL-STD 454. This fully solder-masked board provides the user with a 4 MHz Z80A microprocessor based system, a Z80A CTC time and real-time clock, and up to 8K bytes of intermixable EPROM/RAM.

For the serial I/O function, the board uses a Z80A SIO providing two RS-232 ports with software selectable baud rates ranging from 45 to a maximum of 9,600 baud. The faster 19,200 rate is not available, nor are current-loop interfaces provided—but who really uses current-loop circuitry anymore? Both serial ports include full handshaking signals for use with synchronous transmission. In addition, the serial ports may be operated under interrupt control for faster software response. Two parallel ports are provided by a Z80A PIO chip, which gives one bidirectional 8-bit port plus four handshaking lines. The second parallel port has three data lines available, which may be configured as either input or output lines. The remaining lines of this port are used for on-board functions within the unit; if these reserved functions are not required, the lines become available for user specifiable applications.

As part of the standard unit, a 2K monitor is provided, which has routines for initializing the LSI circuits of the board and programming the Intel-type 2716 EPROMs. The EPROM programming circuitry is also included on the board, with the exception of the 25 v programming supply, which is probably the single major oversight of the entire design. The user must supply +25.5 +/− 0.7 volts at 50 mA to program the EPROMs. Unfortunately, this is not usually an easy task—most small businesses and home users don't have a power supply hanging around. While this technique provides the ultimate degree of protection against inadvertently destroying the contents of an EPROM, it was possible to provide the high programming voltage required with a dc-to-dc converter (a blocking oscillator would have been sufficient), then use a manual switch to protect the EPROM.

The on-board monitor also provides routines for assigning input and output devices, moving, modifying and verifying memory contents and routines for reading and writing from the floppy disk. These routines will support either single or double density, single or double sided and (with some modifications) both 5¼-in. and 8-in. drives may be intermixed. The monitor also provides the routines necessary to interface the floppy

disk drive to the system, which means that the operating system need only be able to access the monitor "hooks" to perform disk operations.

The floppy disk drives are controlled by essentially a single integrated circuit—the NEC 765 floppy disk controller. This chip provides single and double density data transfer, under software control, simultaneous seek operations on all drives connected to the system (a real time saver), IBM compatible formatting and an ANSI standard 50 pin disk drive connector. When interfacing to 5¼-in. drives, a 50 to 35 pin adapter card from Teletek must be used. This adapter saves the space that would be required to provide a dedicated connector for the 5¼-in. drives. The NEC IC also provides automatic error-checking via CRC (cylic redundancy character), software selection of the track sector size from 128, 256, 512 or 1024 bytes.

The device has been designed to be fully IEEE S-100 bus compatible, and will allow memory bank selection using the Cromemco bank select protocol. There is no need for a "phantom" line on this board, as the FDC-I is fully aware of the lack of a memory and will only enable the data input buffers during an external memory access. All that is necessary is to supply a 64K RAM board, either static or dynamic. The board supplies the necessary refresh signal timing, and any essential peripherals to have an up and running microcomputer. The $795 list price seems reasonable, but a special price of $595 is presently offered to new customers.

Sturdy construction

The board is well-built; it is constructed to meet the requirements of MIL-STD 454, with a gold plated edge connector providing all 100 pins. While not all the pins are used, it is nice to have them in case user modifications are desired. The board is fully packed; to conserve space, the resistors are mounted on end. One additional nice touch is that all the integrated circuits are socketed, not just the memory and the expensive LSI chips; this is very useful when trouble-shooting a board. As a further indication of the professional design and construction techniques, the clock oscillator is provided by a Motorola LOCO II, 16 MHz unit, rather than the less reliable two NAND gate approach.

The heart of the board is the Z80A CPU operating in conjunction with U-25, a bipolar PROM, which "maps" the four memory sockets. Depending upon the memory map stored in this PROM, the unit may be configured for any desired mixture of 2716 EPROMs or 1K, or 2K, static RAM. The table gives some of the popular memory arrangements available as selectable options. The board I tested was equipped with the "standard" option, M1; however, only a single 2716 PROM was in place, along with the Mostek MK4118N, 1K RAM. This configuration is skimpy, but fully adequate to test the board operation.

Another bipolar PROM, located at U-12, is programmed to generate the S-100 status signals from the Z80A mode lines, a very elegant method of solving this decode problem. These signals are required for IEEE S-100 compatibility, and are also used by the peripherals to coordinate their activities. The I/O select logic is performed with more "standard" logic design employing LS138 3-input, 8-output decoders. These lines are used as chip select signals to select either the SIO, the PIO, the CTC or the FDC data port.

The Motorola LOCO II crystal oscillator circuit provides the basic timing reference for all board timing, which is divided by U-15, a 4-bit counter, to form the necessary operational frequencies—8, 4, 2 and 1 MHz signals are available as outputs from this circuit. The company has provided jumpers near this circuit to allow the user to change the Z80A clock frequency and the 2 MHz clock.

Probably as important as the Z80A is the central element of the floppy disk control portion of the FDC-I, the NEC uPD-765 floppy disk control chip. This IC provides for control of up to four floppy disk drives that can be a mixture of both 5¼-in. and 8-in. drives with appropriate software. The intermix control is through one unused line of PIO-B. This control line is connected to the control inputs of the two LS157 IC7s, which are part of the floppy disk controller phase locked loop. Depending on the level of this control line, the VCO and the phase-locked loop are configured for either mini- or maxi-drives, and the pre-write compensation is also adjusted. The NEC 765 also provides for either single or double density and will operate with both single and double sided drives. The unit employs the reasonably standard disk data encoding scheme, where single density information is recorded using FM (frequency modulation) formats, and double density is achieved with MFM (modified frequency modulation) techniques. The MFM data pulse density is almost exactly one-half of the combined clock and data pulse density used to write FM, or single density. Some penalty must be paid in the data recovery circuitry for the sophistication of

Table of Memory Arrangements

Option	*Description*
M1*	3 programmable EPROMs (U-34, 35, 36), from E000 to F7ff, and 1 RAM (U-37), from F800 to FFFF. The FDC-I occupies 8K of memory space.
M2	2 programmable EPROMs (U-34, 35), from F000 to FFFF, and no other memory on-board. The FDC-I occupies 4K of memory space.
M3	1 non-programmable EPROM (U-34), from F000 to F7FF and no other memory on-board. The FDC-I occupies 2K of memory space.
M4	2 programmable EPROMs (U-34, 35), from E000 to EFFF, and 2 RAMs (U-36, 37), from F000 to FFFF. The FDC-I occupies 8K of memory space.
M5**	1 non-programmable EPROM (U-34), from F800 to FFFF, and no other memory on-board. The FDC-I occupies 2K of memory space.
M6**	1 non-programmable EPROM (U-34), from F800 to FFFF, and 1 RAM (U-37), from F0000 to F7FF. The FDC-I occupies 4K of memory space.

*This is the standard option.
**This option provides the greatest amount of contiguous RAM space.

MFM recording, but as the bit density on the recorded media is approximately equal to the single density case, the disk bit error rate is no worse when double density recording is used—and you get twice the data storage per disk.

The unit also provides a jump-on-reset circuit combined with a reset and power-on-clear function. These two circuits force the internal EPROM to address P0 whenever the S-100 signal PRESET (pin 75) is active. This EPROM has been programmed with a jump instruction to the on-board memory, allowing the reset, or power-on-clear, to jump absolutely to any desired location. With the board configuration supplied to me for testing, this jump circuitry and software takes you to the on-board monitor.

The FDC-I provides interrupt functions by operating in interrupt mode 2. In this mode, a requesting peripheral generates an interrupt, and when that interrupt is acknowledged, the CPU will expect the interrupting peripheral to place an 8-bit address vector on the data lines. The CPU will add this 8-bit address to the contents of an internal 8-bit register to form a 16-bit absolute memory address. This address then points to a 2-byte location in memory, which contains the absolute address of the desired service routine. To ease software design, the interrupt enable function is controlled by the SEEK/RW signal from the floppy disk controller circuit. During data transfer to/from the disk drive, all interrupts other than the floppy controller are disabled. Teletek has also done some of the interrupt daisy-chaining by series connecting the Z80 peripheral ICs on the board, which makes life a little easier for the user.

Bringing the unit on-line is a veritable snap, even allowing for the user customizations available. The FDC-I needs only to be plugged into a standard S-100 bus to obtain the proper power and ground connections. It is not even necessary to provide signal terminations. The terminal is connected normally to SIO-A, which is the primary port, using a 16-pin flat cable connector. Using the standard monitor software supplied, SIO-A can determine the baud rate used by the terminal through the transmission of successive carriage returns. The full set of handshake lines must be connected and functioning before this serial port will become operational. Also the correct data transfer protocol (number of start bits, number of stop bits, parity, etc.) must be correct before the terminal will function.

In my case, the terminal required two stop bits for any baud rate above 110, and the FDC-I only provided a single stop bit at all baud rates. A call to Teletek was answered very promptly, and we were provided with the necessary changes to the monitor program to provide the needed extra stop bit. It was then a simple matter to use the on-board EPROM programmer to change the monitor (the terminal was operating at 110 baud, of course, for the modification, and my lab does have a 25.5 volt supply available) and we were up and running at 9600 baud.

Easy configurations possible

The floppy disk controller and drive were just as easily configured, requiring only the selection of the appropriate value of pre-write compensation, and the addition of a capacitor to extend the drive head load time. Two values of pre-write compensation are provided, 250 nS—standard and 125 nS—optional. These are the values for the 8-in. drives. When using 5¼-in. drives, the pre-write compensation is doubled.

Pre-write compensation is particularly important when using double density recording, as it is necessary to compensate for the timing shifts produced by certain configurations of the magnetic flux patterns recorded on the disk. The unit includes the provision for extending the head load time from the nominal value of 240 mS up to 11.3 seconds by the addition of an extra capacitor. In some applications, the nominal value of 240 mS will cause an undue amount of head action with the undesirable effects of increased wear to the drive and increased damage to the disk media. I chose to add a 110 ufd capacitor, which increased the time to approximately 5 seconds.

All of the above modifications (with the exception of the stop bit change) are fully detailed in the quite extensive manual provided with the board. The manual runs well over 75 pages and includes a full discussion of the operation of the board, the setup and configuration instructions, the full listing of the standard monitor and the data sheets for the NEC uPD765 floppy disk controller IC. Also included is a listing for a video utility package, a format program, and even a CP/M 1.4 BIOS. The only item missing from the manual is the board schematics; to obtain them, you must request them from Teletek and sign a non-disclosure agreement.

Putting aside a few minor quibbles, the Teletek FDC-I is one whale of a board, both in design criteria and in execution. In essence, an entire microcomputer is available for a reasonable price. □

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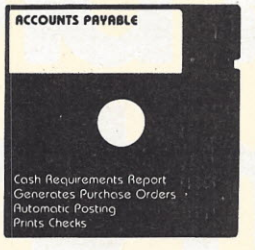

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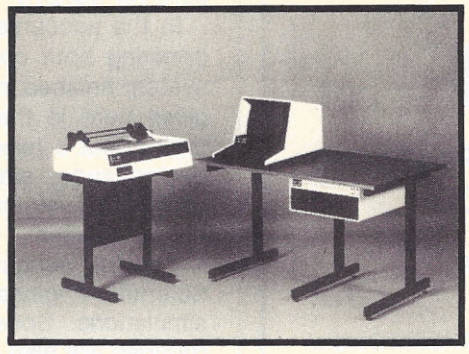
CIRCLE INQUIRY NO. 70

Assignment: Benchmark

Digital Microsystems' DSC-2



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Pertec PC 2000	6:04.3	$12,470
DECstation 78	5:04.8*	$10,495
Vector Graphic System B	5:56.5	$ 8,995
Texas Instruments Model 771	3:38.1	$12,100
North Star Horizon	1:57.7	$ 6,911
Cromemco System Two	2:48.0	$ 9,275
Data General		
Alpha Micro	*to be covered in future issues*	
Ohio Scientific		

*Includes both compile and run time

**Program optimized by Radio Shack ran in 2:59.3

by Hillel Segal

The Digital Microsystems' DSC-2 gave a good overall performance in benchmark testing conducted by the Association of Computer Users.

A single-user CP/M-compatible computer, the unit is notable for its flexible and expandable disk storage system. While its performance seemed adequate, the system is being phased out of the company's product line in favor of a newer model, the DSC-3. It is also a single-user CP/M system, but (unlike the DSC-2) can be used in Digital Micro's Hinet communications networking system.

The Hinet is an RS-422 standard high-speed data link; as many as 250 devices can be attached. Using the company's newer products, the DSC-3 and multi-user DSC-4, a distributed processing system for larger offices can be put together.

Where does that leave the DSC-2? It is still being marketed, but only to those customers who already have existing systems. Others are steered to the newer products.

It is a fact of life in the computer industry that systems come and go. The pace of change in technology for small systems is incredibly fast, and vendors are hard put to keep their equipment up to date. So are users... and benchmark testers.

We ran into the same problem in testing the computers in series 2, which covers the $15,000 to $25,000 price range. We had no sooner published a report on the IBM 5110 when it was obsoleted by the 5120. By the end of the series, one of the manufacturers was out of business entirely, while another product was also discontinued.

If this causes a bit of teeth-gnashing for us, imagine the chagrin of a customer who wakes up to find that the computer he thought was the latest thing is now a has-been. The most we can hope for is that the vendor will continue supporting the software and hardware.

We are striving to keep the report series up to date by beginning a continuation series of reports covering the series 1 (under-$15,000) and series 2 price ranges. Here we'll have a chance to cover some of the systems introduced since the original tests were run.

Let's look at the DSC-2's performance in comparison with the other systems in the original 12 tested for series 1. Configured with 64K bytes of memory and two double-density 8-in. floppy disks, a Hazeltine 1500 CRT and Texas Instruments model 810 printer, the unit sells for $9,015.

In the accounts receivable test, a real-life program involving both computation and disk file access, the system finished in 3 minutes, 28.8 seconds. The time given here is the run-time; a separate compile step took about a minute, but would not affect on-the-job performance, since the compilation is done during program development rather than during actual use for the application.

The full Benchmark Reports also include times for Scientific/Engineering and New Product Planning simulations. Speed tests for math and disk access routines are also reported.

One feature of the hardware deserves special mention: the unusually flexible disk storage arrangement. The separate disk controller board in the main cabinet can drive from one to four floppies and can accommodate single or double density disks, either single-sided or double-sided. Using four double-sided double-density disks, 4M bytes of storage can be on-line.

For applications requiring more storage capacity, Shugart hard disk drives are available. Two sizes are offered: 13.7M-byte and 27.4M-byte. Both use a fixed disk and incorporate an intelligent disk controller with its own buffer area.

A head-per-track option is also offered for the hard-surface disk. Using this feature, eight fixed-position heads are added to the bottom surface of the disk drive. They provide a special high-speed disk access area, which reduces waiting time for frequently-accessed data.

Digital Microsystems sells its equipment through a network of dealers and OEMs rather than directly to the end user. While CP/M and Oasis operating systems are available for the equipment, no applications software is provided by the manufacturer. It's the responsibility of the dealer to provide either a stock or customized set of programs for customers to use.

While this type of arrangement between manufacturer, vendor and user is fairly common and can work well, it placed a greater burden on the local dealer to provide all the needed software, equipment service, training and after-sale support. Potential customers are advised to check the references of the dealer carefully. If the dealer should go out of business or discontinue the product line, the customer, lacking factory support as a backup, may be left in the cold. □

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several foreign countries.

One of the association's key activities is the publication of its Benchmark Reports. Each month a new report is produced covering a computer system.

In addition, ACU publishes seven bimonthly newsletters for users of small computers, midi computers, large computers, time-sharing systems, distributed processing systems, word processing systems and home and hobbyist computers.

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System of the Month

The Osborne 1

by Carl Heintz

When the first product announcements for the Osborne 1 appeared, we took them with more than a few grains of salt. Quite frankly, we were skeptical that any company, particularly an upstart firm like Osborne Computers could possibly produce a *really* portable, complete computer. The product announcements proclaimed the new Osborne 1 as a breakthrough in technology and design; we had heard that all too many times.

Before we review the machine, it might be useful to restate some of the golden truths of microcomputing: at least an 8-in. monitor is required for any business application; the video screen must be at least 80 columns wide; at least 200K of disk are required for any substantial business application; the machine must be upwardly compatible; and applications programs are seldom sold as part of the computer.

The first observation about the Osborne 1 is that it breaks all the rules we formulated above. To add to this, it does it at a very low price of only $1,795. We found nothing seriously wrong with the machine. It offers positive things—just like the software that comes standard with it.

The system is a complete, portable microcomputer that includes 64K RAM, a Z80 processor, two 100K (single density, single sided) disk drives and a 5-in. monitor, all in a plastic case with handle, ready to go anywhere the user needs computing power. The system includes a serial RS-232C port for a printer, an IEEE 488 port, a modem input, output for a separate 12-in. video monitor and provisions for a separate battery pack. The package comes complete with the following software: CP/M 2.2—operating system; MBasic5 and CBasic2—two basic language dialects; SuperCalc—a VisiCalc-type of electronic worksheet; Wordstar—word processing program by MicroPro; and Mailmerge—an extension of Wordstar that produces mailing lists, form letters, and helps in the creation of large documents.

The retail price includes all of the user software. Options include a separate 12-video monitor, a modem cable and acoustic coupler, a battery pack for up to five hours of operation, and upgrades on the disk drives up to 200K each (total of 400K). The system, through the IEEE 488 bus, is compatible with a configuration for operating the Corvus hard disk.

The system is probably best compared to the TRS-80 model III or the Apple II in terms of size and capabilities. The incredible thing about the Osborne is that unlike either the Radio Shack or the Apple, it is truly portable and essentially self-contained.

The accompanying comparison table is by no means complete, since it does not address some of the major issues for a computer user, but it does offer a few insights. Take for example the issue of software. Both the TRS-80 III and the Apple use proprietary operating systems unique to their own machines. The Osborne system uses CP/M, which is the industry standard for business applications. The Osborne comes with two excellent sets of applications software, a word processing system and an "electronic worksheet." Neither the TRS-80 nor Apple include an applications software in their base price.

The Osborne 1 includes the capabilities for limited graphics on the terminal, which are comparable to the low level graphics of the TRS-80 III. There is no provision for sound or high resolution graphics, as in the Apple.

The most obvious question is whether the 5-in. monitor is sufficient. It appears very small in the photo, and not many users will want to have it very far from them. The screen is very clear, especially if the controls for contrast and brightness are adjusted well for the ambient light conditions. In most cases, the terminal should be adequate. However, if your eyes are weak, there is a distinct possibility that some of the letters may blur a bit and a comma may be indistinguishable from a period. The screen size is one of the big negatives of the system. To compensate for this, Osborne offers an outboard 12-in. monitor that is more than sufficient for all applications, although it does not fit in the case, making the computer less portable.

As mentioned earlier, the Osborne video monitor is basically a window that is 52 characters wide. Lines may be up to 128 characters long, and the user can scroll

back and forth to view any 52 characters. When using the word processing system (MicroPro's Wordstar), the monitor automatically scrolls over as you enter a line if it is longer than 52 characters. Under Basic, however, this does not occur, but one can scroll over. The software was set to "auto-return" (word-wrap) at 64 characters wide, so the user normally does not see the whole line. It's not easy to review text that way, but it is adequate. Another disadvantage to the 52 limit occurs when the user looks at the menus for the word processor—only the first 52 characters appear. In actual usage, however, these are only minor irritations that the user quickly realizes are necessary in order to achieve total portability.

The second major question that most potential purchasers will probably have is whether the disk storage is adequate. That is a legitimate concern, since with the CP/M system in a minimum configuration with the applications program, the user is likely to have less than 120K of storage space left over for data files between the two disks. Unlike other systems, such as the TRS-80 III and the Apple, there are no provisions for more than two disk drives, although a hard disk can reportedly be added through the IEEE 488 bus. This should generally be sufficient for word processing—except those applications such as book writing, where several disks will be required. In many financial applications, however, the limitations imposed by the disks may require an upgrade to the 200K disks offered as an option. The disk speed is not overwhelming, but it is adequate and fast enough for most applications. (Wordstar, for example, uses a number of overlays from the disk. While disk access slows down the system, it's not annoying.)

The final major question that a potential user is likely to raise is the matter of how well the machine is constructed. At the extremely low price of less than $1,800, one wonders whether the machine has some built-in engineering shortcuts that could cause problems later. In our test machine, we noted that there is no fan, nor are there any ventilation holes, other than on the front cover. This means that the computer case gets a bit warm. The problem is largely solved, however, by propping the computer up so that the heat vents out the hole in the front. We propped it up on the keyboard unit, a move that solved two problems—the screen was closer and the heat was reduced significantly.

Power supply shortcut

The only obvious engineering shortcut is in the power supply. Anyone who has used a TRS-80 model I knows that when the disk drives click on, there's generally a very small flutter in the video monitor. This same malady sometimes exists with the Osborne 1, only to a lesser extent. The problem is not even minor, except for the engineering purist.

Frankly, there will be some potential buyers who are unimpressed with the physical construction of the unit. While sturdy and fully functional, the unit reviewed had a vacuum formed plastic case and front panel—not the neat injected molded plastic that the Apple and the TRS-80 III use. The company claims, however, that a molded plastic case will soon be standard.

The manual for the computer was obviously written for someone who had not owned a computer before. It leads the user very carefully through the set-up and use of the machine from unpacking to setting up and running the programs. The manual even contains an overview of the Wordstar, SuperCalc, Mailmerge, CP/M, MBasic and CBasic 2 programs that are supplied. For the novice user, the manual is excellent.

It contains very little about the physical aspects of the machine, other than how to set it up. There is no circuit diagram, nor is there any trouble-shooting guide. Further, there is no discussion of the monitor program, although there is an assembly programmers guide, which gives some elementary information necessary to interface the machine with the outside world, particularly through the IEEE 488 bus. This level of documentation is consistent with the intended users of the machine—businessmen who don't know and don't care about the details of its inner workings.

The software provided with the machine is impressive: if one adds up the list price of all the software provided, it appears that the hardware itself costs slightly more than $400. Wordstar and Mailmerge are outstanding word processing programs—by one of the best vendors in the business—MicroPro International. SuperCalc is, in essence, a VisiCalc-type program that runs on CP/M. MBasic and/or CBasic 2 are necessary for almost any applications program—it is significant that both of them are included as standard with the machine.

	Osborne 1	Apple II	TRS-80 III
Memory available	64K	64K (opt)	48K
Disk capacity	2 @ 100K	2 @ 104 (opt)	2 @ 178
Monitor	5-in. across 52 character 24 lines	optional 40 character 24 lines	8-in. 64 character 14 lines
Upper/Lower case	yes	no	yes
Numeric keypad	yes	optional	yes
Standard typewriter keyboard	yes	no	yes
Serial Terminal port	yes	optional	yes
Systems clock	yes	optional	yes
Price	$1,795	$2,500 (with monitor)	$2,500

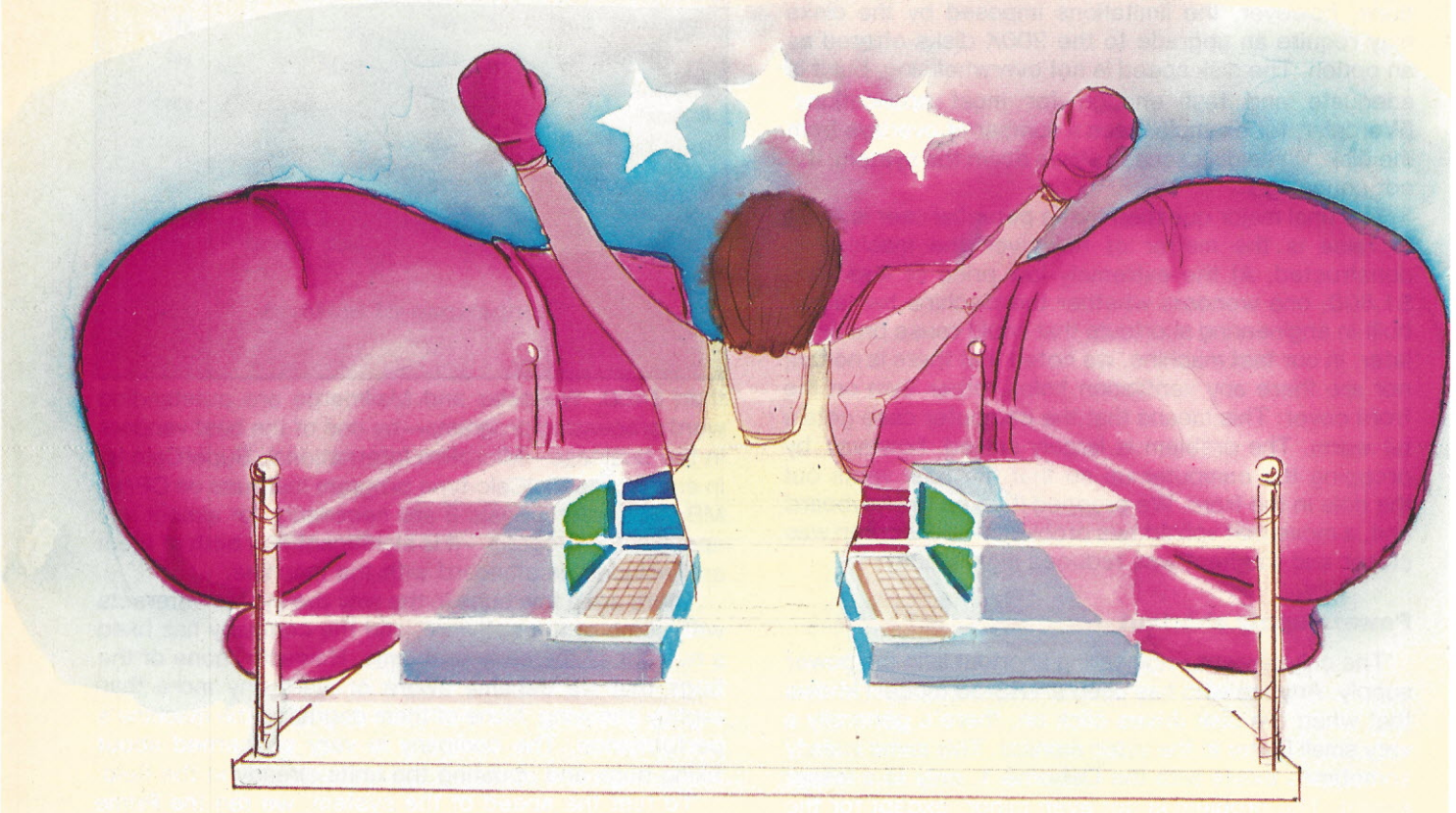
Comparison of features

There are a few bugs in the way the system interacts with some of the software, and the company has fixed a number of the early problems. However, none of the bugs that we became aware of were any more than slightly annoying. None of them degraded the machine's performance. The company is very concerned about fixing bugs and updating the units already in the field.

To test the speed of the system, we ran the Prime Number Cruncher benchmark (IA Aug 81). The speed of the Osborne was not lightning: it took 14 minutes and 25 seconds to complete the task of finding all the primes under 1,000.

For value received, the system represents an outstanding buy. It's a great little machine for the businessman who wants to "take it with him" in the field, and it should find good application as a versatile business tool to perform routine word processing, financial analysis, and limited applications programming. □

DEDICATED WORD PROCESSORS VS. MICRO-BASED SYSTEMS



by Dennis Christopher

Why would a business choose to purchase a $12,000 microcomputer when a $4,500 model will do the same job? That question will be asked with greater frequency in the future, as word processors threaten to eliminate the unintelligent typewriter in all but the smallest offices. Microcomputer manufacturers such as Tandy, Apple and Commodore find themselves competing with the giants of the office equipment industry.

For the medium to small-sized users, the choice between a top-end $12,000 dedicated word processing machine and a more flexible microcomputer at half to a third that price can be a difficult one. Cost is not the only factor. When applied properly to a business environment, the productivity and time savings offered by word processing make the $7,500 maximum price differential between two popular systems seem inconsequential. When the smaller spread between the latest dedicated systems is compared to micro equipment, the cost comparison dwindles further.

I've had extensive experience with both microcomputer and dedicated word processing machines. For eight months, I wrote approximately 2,000 words per day using a TRS-80 model I and Scripsit. I demonstrated the system to my partners, and after appropriate comparison studies, we elected to invest in three Xerox 860 dedicated word processing machines. I used my terminal exclusively for six months, but have recently resumed using the TRS-80 for certain applications. Most businesses must consider just how they will be using equipment before deciding whether they will best be served by a microcomputer or a dedicated word processor.

WP terminals were designed especially for that task; most microcomputers were not. Many micros lack certain hardware features considered essential for word processing.

These can be as basic as the lack of an 80-character display line on the CRT, or absence of built-in lowercase. Some micros don't have a control key, and must have one added by hardware or software means in order to invoke frequently used word processing commands. Software written to compensate for these shortcomings in design is often needlessly complex. It may be necessary for the operator to enter EDIT mode, COMMAND mode or CREATE mode in order to perform certain tasks that can be initiated by striking a single key on a dedicated unit.

Some design faults cannot be overcome by hardware or software patches. I find composing text on a 64-character display much more difficult than on an 80-character screen, which is designed to show a full page of text exactly as it will appear on paper. Yet, there is no simple way to add an 80-character CRT to the TRS-80 model I that I use with Scripsit. Such limitations have to be accepted if one chooses that micro over a WP terminal.

Dedicated units are built with high resolution screens that can display a full or partial page of text. Status lines that present useful information are often presented in reverse-video to clearly differentiate between text and extraneous material. The user can often toggle back and forth between black-on-white and white-on-black display at will.

Some micros also have these capabilities to a certain extent, but dedicated units generally have thousands of hours of human factors research behind them. Instead of a single control key, WP terminals have an array of special function keys, which can command the system to store, insert, move or copy text at a single stroke. These keys are laid out to fall easily under the finger. While some micros have some of these advanced design features, I know of none that have them all. Each lends itself to improving productivity, reducing operator fatigue and making the system easier to use.

Higher cost terminals may have gold plated PC card contacts where a micro has oxidation-prone solder runs. Both my Xerox 860 and my TRS-80 are located in the same basement office, which tends to be rather humid in the summer. It's been necessary to carefully scrub PC card contacts with an eraser every few days to keep the Radio Shack computer operating. The dedicated terminal's gold-plated edge cards require no attention whatsoever. The more sophisticated design and construction made possible by the higher price of the WP unit can result in a heavier-duty unit that can withstand abuse and lack of maintenance.

Configurations are flexible

Micros deserve a few points in the plus column for design features. Users of these units, unlike operators of dedicated word processing devices, are not locked into the configurations the factories mandate. Suppliers other than the original manufacturer offer improvements that may enable a business to tailor its WP equipment to suit some fairly unusual needs. If color graphics are needed for some reason (doubtful for most word processing applications), a computer can be chosen with that capability. Some micros can be outfitted with up to eight different disk drives, or set up to dump text files to cassette tape for portable operation.

Most custom modifications to micro systems are simple plug-in changes. Others require some knowledge of digital electronics. In either case, the average user should be able to find a local dealer who can modify a micro to suit any particular application. Though the S-100 modular computer has fallen from favor somewhat since such systems as Radio Shack, Apple and Atari became available, there is still a network of business computer shops with the knowhow and inclination to configure custom systems.

Dedicated word processors, on the other hand, are turnkey systems that few users or dealers are equipped to fool around with. It's wise to plan a business' activities only on the features already available and implemented in a given piece of equipment. My company waited six months for the promised telecommunications capability that would link all of our offices.

Though the support and implementation of that capability provided by Xerox was superb, the delay derailed our plans somewhat. A good rule to remember: the WP system that the sales person shows you is the one you get. Never mind what future capabilities, enhancements and plans are slated. All those plans could be supplanted by a newer model from the manufacturer, not 100% compatible with the old one. If you count only on the features demonstrated before the purchase, you will lessen your chances of being disappointed.

Whether contemplating micro based or dedicated WP equipment, the design of the machine should be considered in light of a business' need before a specific word processing system is chosen. Some may prefer the sophisticated features of the terminals. A business

with a high volume output can find that operator productivity on the best-designed machines can have a measurable impact on a company or division's profits. Others may wish to save money with a micro now and upgrade at some later date.

Getting a microcomputer word processing system repaired tends to be somewhat inconvenient, but fairly inexpensive. Frequently, it's just a matter of unplugging the equipment and taking it down to the local computer store. Repairs may take from a few hours to a week, and are modest in price, considering the price of the equipment. Radio Shack, for example, offers reasonable, fixed fees for repairing most pieces of equipment that have not been modified by the user.

A WP terminal is usually much simpler to have fixed. A technician will be at your office in a few hours and repair the equipment on the spot—even if an entire PC board has to be replaced. One vexing problem I had with my own dedicated WP machine required a new PC card that wasn't stocked by our local office. The technician had it flown in from the nearest warehouse, and my machine was working the next business day.

Microcomputers provide good portable word processing capabilities.

Problems resulting in downtime measured in days are relatively rare. If there is no backup terminal available (which may be the case both with dedicated and micro-based units), the working time lost due to maintenance is likely to be minimal. These potential savings in time have to be weighed against the cost of service for WP terminals.

Service contracts can cost several hundred dollars per month for a single terminal. Time-and-materials billings can mount quickly. In many businesses, a lost hour can easily cost a company much more than the price of maintaining a dedicated terminal. Other businesses have cost-justified their word processing equipment on a much slimmer margin. Those with lower overhead may want to give more weight to the cart-it-yourself service available for micro-based systems.

Most dedicated units aren't portable—it's enough of a chore to wheel them from one location to another in the same office. Microcomputer systems, on the other hand, can be toted wherever the user needs to employ the device. If the printer is left behind, a microcomputer CPU, disk drives and CRT can be taken on the road easily and used in a motel room. Carried by car or onboard an airplane, such systems provide a fairly portable word processing capability to traveling executives, writers and others. Linked to their offices by modems, these units make it possible to establish an office anywhere the user roams.

Those with an investment in WP terminals aren't totally left behind in portability, however. There are several portable terminals that can be carried on trips and used to interface with the larger, less-wieldy equipment back at the office. Sony's Typecorder is the smallest of these. The future should see a veritable flood of these devices. However, all require an additional investment that can amount to nearly as much as a micro user will pay for his entire system, less printer. A microcomputer is portable; a dedicated word processing terminal can be made to work with an additional input device that is also portable. The distinction can cost those with tight budgets several thousand dollars.

Those using a dedicated machine are locked into the software provided by the manufacturer. Some units cannot function as anything other than a word processor. Others can be used as computers when supplied with a Basic interpreter or some other language that allows program creation and editing. Even so configured, a WP terminal is not likely to be as flexible a computing machine as a microcomputer. Basic design comes into play again: WP terminals, for example, usually don't have a calculator-style numeric keypad, which makes entering numbers fast. Try posting several hours of general ledger entries using the top line of your word processing terminal to see what I mean.

Those who own one of the popular units like the Apple or TRS-80 have available a wealth of software, produced by the manufacturer and independent suppliers. While a general ledger package may be available for a given dedicated system, any micro worth its salt has hundreds of such programs accessible to the user. The major manufacturers have given a nod of acknowledgement to this reality by their introduction of the personal-sized equipment, such as the Xerox 820, which can use any CP/M programming with its Z-80 processor. That particular unit should be lumped in with the other micro-based systems in any study, despite its pedigree origin.

Micro users gain much flexibility from the broad range of software available. They may even choose from a wide variety of word processing programs to meet nearly any need.

While dedicated WP terminals tend to be very operator-oriented, and feature-laden, a specific user may find that a machine doesn't really suit his needs. A business may grow into new areas requiring different capabilities. Writers, for example, because they create the copy as it is input, have different work habits than typists who are entering text from hand-written notes, tape recorded dictation or typed originals. The latter may prefer to use a word processor that "enlarges" the current character or line being input, so the typist's place may be easily found when glancing back and forth from original copy to the CRT screen. A writer may find this distracting. A unit that did not allow turning this feature on and off would be maddening.

One who must rely on the manufacturer for programming has to wait until a needed feature is introduced for his specific machine. Hardware enhancements are relatively rare for dedicated units. Such advances usually mandate a new model. Software improvements, while more frequent, must benefit a large number of users before they are implemented.

So, the user of a dedicated machine is fairly well locked in. A TRS-80 owner who must have a feature—embedded control codes, for example—can drop one

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word processing program and find another by a different software house that provides the needed capability. Other micro users may be able to write patches and drivers themselves.

Esoteric factors enter into the decision for some businesses. Our company intended to link all our offices through telecommunications. Articles, reports, assignment data and other information is transmitted regularly. Of course, we could have linked microcomputers exactly as we have tied together our dedicated WP terminals. However, most of our clients use one of the latter, and it is currently far easier to communicate between like machines than from micro to WP terminal. Software to translate the control codes from one system to the other is more readily available for the major systems.

This situation is changing constantly, but at the time we purchased our equipment, the very important communications factor weighed on our decision. Communications support for the system we chose was promised, and was working within a mere half-year.

Things as minor as the amount of noise produced or the amount of time needed to load the word processing software may enter into a decision.

The very heavy user of word processing equipment may decide that the typical price differential of $7,500 is very small. Marginal users may find it overwhelming. For some, even the difference between a minimal several thousand dollar micro system (with Selectric terminal, or dot matrix printer), and the low-end dedicated systems at $6,000-$7000 can be imposing.

Consider also that some candidates for word processing may already have a microcomputer installed and working for accounts payable/receivable/general ledger or inventory. If free time is available on the machine, the actual startup cost of such a WP system may be as low as a few hundred dollars for software, or as high as the cost of a daisy wheel printer. In either case, it is likely to be $5,000-$10,000 less than a complete dedicated system.

Look at the business that needs a word processing system for some work and a small computer for other jobs—but has neither. It can obtain both machines for a single $5,000 investment, instead of purchasing a $7,000-$12,000 WP terminal and a $12,000 computer (which may be overkill for a user small enough to get by happily with a $5,000 micro). Even if the word processing device can be adapted for computer operation, software may not be as widely available as for a micro.

Even this cursory examination of some of the factors involved in the choice reveals that each option may be suited for some users, while the other will be ideal for a different type of application.

The wide availability of micro word processors has not seemed to erode the sales of WP terminals in the least. Each has found its own market, with a predictable amount of overlap. The microcomputer, because of its low cost, has largely made its own market, bringing word processing power to those who could never afford such capabilities before.

In the 1980s, both types of systems will continue to thrive as prices drop further at the high and low ends. Innovations like the Sony Typecorder bring us closer to the time when the electric typewriter as we know it will become a rarely-used relic. □

Micro Word Processing vs. Dedicated Units
A comparison of two typical configurations

	Xerox 860 Partial Page	Radio Shack TRS-80 model III
Printer	45 cps Diablo	25 cps daisy wheel
Display	Half-page, 90 + characters Reverse video built-in	Partial page, 64 characters wide White on black only, unless user modifies
Disk	Two 8-in. single sided, single density included. Can expand to four drives, double density or hard disk from Xerox.	Cost calculated on two 5¼-in. single sided, double density disks. Can expand to four drives, and/or to 8-in. or hard disk through aftermarket accessories.
Software	Xerox word processing software provided; enhancements at no cost. Sophisticated features include merging mailing lists, while printing, columnation. Basic interpreter available ($800); Xerox also has flexible records processing package that might be compared with VisiCalc.	Scripsit, wide variety of WP software available at $79 and up. Many have features necessary for doing mailing lists and other tasks. Basic standard. Fortran, Pascal, other high level languages, as well as assembler Basic compiler, etc. available. Large number of business, personal and game programs marketed at very low cost.
Service	Through Xerox service offices only. Service contract, or by time and materials. More costly than micro service, but extremely fast.	From Radio Shack and many others. User may have ability to do own work. Otherwise carry-in or mail-in service, slower, but less expensive.
Training	Provided by manufacturer, no additional cost.	Up to user, tapes, other aids available.
Cost	Less than $10,000 with lower speed printer and no cursor control pad.	Less than $4,500 with two disk drives, and daisy wheel printer.

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(Note: Even though GENESIS runs in compiled PL/1-80* it is not necessary to have PL/1-80* in order to run the program.)

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Choosing Your Printer Hardware

by Larry C. Raymond
and Jacqueline M. Raymond

Of all the peripherals associated with a computer system, the printer is often the major focus of attention. Much is expected of this device—it is the hardest worked and sometimes the most expensive component. One of the primary functions of electronic data processing is to produce reports. Whether the installation is oriented towards business, science or accounting, the production and printing of hard copy reports is necessary for success in today's business world.

As the demand for quality printers has increased, the printer industry has made great strides through circuit development. The technology of microelectronics has given the manufacturers a remarkable boost. Faster printing speeds, lower energy consumption, less maintenance, more reliability and greater affordability are a few of the results. Technology is now moving toward increasing the density of logic devices per circuit; as the density increases, the cost decreases. As a result, a small business can usually find a fast, reliable, versatile printer suited to its applications.

There are two major types of printers, character and line varieties. Line printers are capable of producing hard copy at a very high speed. They generally offer a wide variety of print types, and are comparatively expensive. To remain within a budget, it is often necessary for the smaller business to sacrifice some of the speed and purchase a character printer. Character printers are available in a wide price range.

Character printers function either by the full-form method of printing the complete, solid character, or the dot matrix way of forming the character from a grid of dots. Full-formed character printers are the traditional standard for letter quality applications; e.g., business correspondence, word processing, etc. Dot matrix is a newer technology. This type of printer is faster, less costly and more versatile than full-formed, but is often far from letter quality. One development direction is toward more solid appearing characters—the more pins that go to form the matrix, the more dense the printed character appears. Multiple pass is another method used to approach letter quality results. As many as three passes of the printhead may be made over the same characters, and in some cases the printhead is shifted slightly with each pass to help fill in the character.

Increased printer buffer areas and printer intelligence make the newer printers capable of handling more data

faster. Dot matrix adds the capacities of varying size, script and character set, of utilizing a graphics mode, and of ease of printhead maintenance and interchangeability.

Character printers that can interface with small systems are available from over a hundred manufacturers. The accompanying table will focus upon the diverse technologies available in current products, in order to make a feature-by-feature comparison.

They are intended to present a cross-section of the more affordable printers available. The information given was provided by an overwhelming response to request letters we sent out. If some piece of data was unavailable on a particular printer, it is indicated as "N/D" (no data). Following are descriptions of the column headings.

Physical specs gives the height, width and depth of the printer, as well as its weight.

Classification indicates whether it is a line or character printer.

Type refers to how the character is graphically produced; whether it is full-formed printing or dot matrix printing.

Method distinguishes between the different methods of transferring the character onto the paper. Primarily, we will discuss thermal and impact printers; other methods include ink jet and laser printing.

Character set tells how many characters are available to the printer to print, as determined by the firmware of dot matrix and the print element of full-formed printers.

Expanded and Compressed Font is an attribute that only a dot matrix printer might possess. It is the ability to print an elongated or a shortened version of a member of the printer's character set.

Handling Method is the mechanical method or device used to feed the paper past the printing component.

Paper Type Used indicates the type of paper needed to work in conjunction with the printer's handling method, i.e. fan-fold (single or multi-part), roll or single sheet.

Interface Type distinguishes between parallel and serial data transmission. A system with parallel interfacing can transmit data (one bit at a time) across eight or ten wires, whereas serial transmission can send single bits across only one wire.

Interface Speed describes the rate at which the printer is able to receive data.

Price lists the manufacturer's suggested retail prices. □

Table follows

Printer Features and Specifications

Manufacturer Name/Address	Model	Physical Specs (in.) (h x w x d)	Classification	Specifications					
				Type	Method	Speed (cps)*	Character Set	Characters per Line	Lines per Inch
Alphacom, Inc. 3031 Tisch Way San Jose, CA 95128	Sprinter 20	n/d	Character	5×8 Dot Matrix	Thermal	n/d	96	20	n/d
	Sprinter 40	n/d	Character	5×8 Dot Matrix	Thermal	n/d	n/d	40	n/d
Amperex Electronics Corp. 230 Duffy Ave. Hicksville, NY 11802	GP-300	7.4×20.5×17.5 44#	Character	9×9 Dot Matrix	Impact	80/300	114	120/144	1/48
Anadex, Inc. 9825 DeSoto Ave. Chatsworth, CA 91311	DP-8000	7.3×18.6×14.2	Character	9×7 Dot Matrix	Impact	112	96	80	6
	DP-9000	8.29×22×15.43 30#	Character	9×9 Dot Matrix	Impact	150/200	96	80/132	6/8
Axiom Corp. 5932 San Fernando Rd. Glendale, CA 91202	GP-80M	5×13×6.7 5.5#	Character	5×7 Dot Matrix	Impact	30	n/d	80	6/9
	EX-801 Micro Printer	4.4×11.8×12.8 12#	Character	5×8 Dot Matrix	Electro-sensitive	n/d	96	20/80	5
Base 2, Inc. P.O. Box 3548 Fullerton, CA 92634	850	3×15×11 15#	Character	5×7 Dot Matrix	Impact	100	96	132	6
Centronics Data Computer One Wall St. Hudson, NH 03051	739	4.9×14.5×11 12#	Character	7×8 Dot Matrix	Impact	100	96	80/132	6
Dataroyal, Inc. 235 Main Dunstable Rd. Nashua, NH 03060	IPS-5000	7×14×18.3 30#	Character	9×9 Dot Matrix	Impact	125	96	80	6
Datasouth Computer Corp. 4740-A Dwight Evans Rd. Charlotte, NC 28210	DS180	7×24×16 35#	Character	9×7 Dot Matrix	Impact	180	96	132	6/8
Digi-Data Corp. 8580 Dorsey Run Rd. Jessup, MD 20794	2511	n/d	Character	n/d	n/d	200	n/d	n/d	n/d
Dip, Inc. 121 Beech St. Boston, MA 02111	DIP-81	3.5×17×9.75	Character	7×7 Dot Matrix	Impact	100	96	80	6/8
	DIP-82	3.5×17×9.75	Character	7×7 Dot Matrix	Impact	100	96	80	6/8
Epson America 23844 Hawthorne Blvd. Torrance, CA 90505	MX-80	4.2×14.7×12 12#	Character	9×9 Dot Matrix	Impact	80	96	80	6-10
	MX-100	5.2×23.3×12.5 21#	Character	18×18 Dot Matrix	Impact	80	96	233	6
Facit Data Products 66 Field Point Rd. Greenwich, CT 06830	4525	7×18.3×14 29.8#	Character	9×9 Dot Matrix	Impact	150	96	80	6/8
	4526	7×24×14 35.1#	Character	9×9 Dot Matrix	Impact	150	96	132	6/8
Florida Data Corp. 600 D John Rodes Blvd. Melbourne, FL 32935	OSP/120	8.5×25×20.5 60#	Character	36×16 Dot Matrix	Impact	600	96	198	6/8
Fujitsu America, Inc. 2945 Oakmead Village Ct. Santa Clara, CA 95051	SP830	7.3×23.5×17.7 39.6#	Character	Full-formed Daisywheel	Impact	80	127	163	n/d
General Electric Co. Data Comm. Products Dept. Waynesboro, VA 22980	TermiNet 2030 (R.O.)	5.5×22×18.5 22#	Character	9×7 Dot Matrix	Impact	60	94	217	2-12
	TermiNet 2120 (R.O.)	5.5×22×18.5 24#	Character	9×7 Dot Matrix	Impact	150	94	n/d	n/d
Hewlett-Packard 1501 Page Mill Rd. Palo Alto, CA 94304	HP 82905	4.2×14.7×12 12#	Character	9×9 Dot Matrix	Impact	80	96	132	6
	HP 2671A	4.1×16.9×16.7 15# 3oz.	Character	7×11 Dot Matrix	Impact	190	128	132	6
Howard Industries 2031 E. Cerritos Ave. 7K Anaheim, CA 92806	Typrinter 221	n/d	Character	Full-formed Daisywheel	Impact	20	100	198	n/d
Integral Data Systems Milford, NH 03055	445	n/d	Character	Dot Matrix	Impact	n/d	n/d	80	n/d
	460	n/d	Character	Dot Matrix	Impact	150	n/d	80	n/d

n/d = no data available *cps unless otherwise noted

Features								Paper		Interface		
Bi-directional Printing	Vertical Tabbing	Graphics	Expanded Font	Compressed Font	"Paper Out" Alarm	Self Test	Other	Handling Method	Paper Types	Type	Speed (Baud)	Price
n/d	n/d	Yes	n/d	n/d	n/d	n/d	Rotated printing	n/d	n/d	Serial Parallel	110-9600	$175
n/d	n/d	Yes	n/d	n/d	n/d	n/d	Rotated printing	n/d	Roll, Fanfold	Serial Parallel	110-9600	$350
n/d	Yes	Yes	n/d	n/d	Yes	Yes	2 Character sets	Friction Tractor Platen	Form, Fan fold, Sheet	Serial Parallel	300-9600	$3,165
Yes	Yes	No	Yes	No	Yes	Yes	12-line buffer	Sprocket	Fan fold, Forms	Serial Parallel	110-9600	$1,125
Yes	n/d	Yes	n/d	Yes	n/d	Yes	n/d	Tractor	Fan fold	Serial Parallel	n/d	$1,550
No	No	Yes	Yes	n/d	n/d	n/d	Uni-hammer design	Tractor	Fan fold, Forms	Serial Parallel	n/d	$399
n/d	n/d	n/d	n/d	n/d	n/d	n/d	256-character buffer	n/d	n/d	Serial	50-1200	$599
Yes	Yes	Yes	n/d	n/d	n/d	Yes	n/d	Friction, Tractor	Fan fold, Roll	Serial Parallel	75-9600	$799
Yes	n/d	Yes	n/d	n/d	Yes	Yes	Underlining	n/d	Roll, Fan fold, Form	Serial Parallel	n/d	$995
Yes	Yes	n/d	No	No	n/d	Yes	n/d	n/d	n/d	n/d	110-9600	$1,110
Yes	Yes	Yes	Yes	n/d	Yes	Yes	1K buffer	Tractor	Fan fold	Serial Parallel	110-9600	$1,595
Yes	n/d	n/d	n/d	n/d	n/d	n/d	Underlining	n/d	n/d	n/d	to 19,200	$1,550
Yes	No	No	n/d	Yes	n/d	Yes	80-character buffer	Friction	Roll, Sheet Fan fold	Serial Parallel	110-1200	$499
Yes	Yes	Yes	n/d	Yes	n/d	Yes	80-character buffer	Friction, Tractor	Roll, Sheet Fan fold	Serial Parallel	110-1200	$695
Yes	Yes	Yes	Yes	Yes	Yes	Yes	1-line buffer	Tractor	Fan fold	Serial Parallel	n/d	$645
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Multi pass	Tractor, Friction	Sheet, Roll, Fan fold	Serial Parallel	n/d	$995
Yes	Yes	n/d	n/d	Yes	n/d	n/d	512-character buffer	Tractor	Fan fold	Serial Parallel	n/d	$1595
Yes	Yes	n/d	n/d	Yes	n/d	n/d	512-character buffer	Tractor	Fan fold	Serial Parallel	n/d	$1,697
Yes	Yes	n/d	No	Yes	Yes	Yes	Double pass	Triple paper path, Cut sheet	Fan fold, Sheet	Serial	n/d	$3,900
Yes	Yes	Yes	n/d	n/d	Yes	No	n/d	Friction, Tractor	Fan fold, Sheet	Serial	n/d	$2,650
Yes	Yes	n/d	n/d	n/d	Yes	Yes	640-character buffer	Friction	Roll	Serial	110-1200	$1,175
Yes	n/d	n/d	n/d	n/d	Yes	Yes	n/d	Friction	n/d	Serial	110-1200	$2,120
Yes	n/d	Yes	Yes	Yes	n/d	Yes	Shortest path seeking	n/d	Fan fold	IEEE-488	n/d	$945
Yes	No	No	Yes	Yes	n/d	n/d	2K-character buffer	n/d	Fan fold, Roll	Serial Parallel	to 9600	$1,095
Yes	Yes	n/d	n/d	n/d	Yes	Yes	Reverse print	Friction	n/d	Serial Parallel	n/d	$2,850
n/d	n/d	Yes	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	$795
Yes	n/d	Yes	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	$995

Printer Features and Specifications (continued)

Manufacturer Name/Address	Model	Physical Specs (in.) (h x w x d)	Classification	Specifications					
				Type	Method	Speed (cps)*	Character Set	Characters per Line	Lines per Inch
C. Itoh Electronics 5301 Beethoven St. Los Angeles, CA 90066	Starwriter	10.2×24.6×14.9 44.1#	Character	Full-formed Daisywheel	Impact	25	96	136	48
Lear Siegler Inc. 714 N. Brookhurst St. Anaheim, CA 92803	310	8×27×19.8 50#	Character	9×12 Dot Matrix	Impact	180	128	224	6/8
Malibu Design Group 2301 Townsgate Rd. Westlake Village, CA 91361	165	n/d	Character	10×9 Dot Matrix	Impact	165	n/d	n/d	n/d
	200	7×23.9×17.1 41#	Character	9×18 Dot Matrix	Impact	250	96	n/d	6/8
Mannesmann Tally Corp. 8301 S. 180th St. Kent, WA 98031	MT-1800	18.5×25.5×19.5 63#	Character	7×9 Dot Matrix	Impact	200	n/d	132/218	6/8
Micro Peripherals Inc. 2099 W. 2200 S. Salt Lake City, UT 84119	88G	6.3×16.3×10.8 15#	Character	11×7 Dot Matrix	Impact	100	96	80-132	6/8
Microtek 9514 Chesapeake Dr. San Diego, CA 92111	Byte-Writer-1	n/d	Character	7×7 Dot Matrix	n/d	60 lpm	n/d	80	n/d
NEC Information Systems 5 Militia Dr. Lexington, MA 02173	5510R0	8.7×25×16.5 45.5#	Character	Full-formed Thimble	Impact	55	128	163	6/8
Okidata Corp. 111 Gaither Dr. Mt. Laurel, NJ 08054	Microline 82A	5.2×14.2×12.9 19.9#	Character	9×9 Dot Matrix	Impact	120	96	80/132	6/8
Pertec Computer Co. 12910 Culver Blvd. Los Angeles, CA 90066	Stylist 360	5.5×20.9×13 28.66#	Character	Full-formed Daisywheel	Impact	17	100	198	n/d
PrintaColor, Inc. 5965 Peachtree Corners E. Norcross, GA 30071	158001	8.2×22×17.4 37.4#	Character	7 color Dot Matrix	Ink Jet	40	n/d	80	n/d
Printerm Printer Terminals Corp. 124 Tenth St. Ramona, CA 92065	879	7.5×18×22 25#	Character	7×9 Dot Matrix	Impact	180	95	80/132	6
Qume Corp. 2350 Qume Dr. San Jose, CA 95131	Sprint 9/55	6.5×24.3×16.75 45#	Character	Full-formed Daisywheel	Impact	55	125	132-198	3-8
Quint Systems, Inc. 3693 Commercial Ave. Northbrook, IL 60062	KSR-743	4.5×14×12 12#	Character	Dot Matrix	Impact	80	n/d	n/d	2-12
Radio Shack 1800 One Tandy Center Fort Worth, TX 76102	Line Printer VII	n/d	Character	5×7 Dot Matrix	Impact	30	n/d	40/80	6
Star Micronics 200 Park Ave. Suite 2308 New York, NY 10166	DP-8480	4.9×15.3×12.2 19#	Character	7×9 Dot Matrix	Impact	80	96	132	n/d
TEI, Inc. 5075 South Loop E. Houston, TX 77033	3431	n/d	Character	9×9 Dot Matrix	Impact	150	94	136	6/8
Texas Instruments P.O. Box 1444 Houston, TX 77001	825 (RO)	n/d	Character	9×7 Dot Matrix	Impact	75	n/d	n/d	6/8
	810 (RO)	n/d	Character	9×7 Dot Matrix	Impact	150	64	n/d	6/8
Wang Laboratories One Industrial Ave. Lowell, MA 01851	2231 W-1	10×24×18 60#	Line	7×9 Dot Matrix	Impact	120	96	112	n/d
	2281W	n/d	Character	Full-formed Daisywheel	Impact	30	86	157	6
XYMEC, Inc. 17905 J Sky Park Circle Irvine, CA 92714	HY-Q 1000	n/d	Character	Full-formed Daisywheel	Impact	20	n/d	198	n/d

n/d = no data available *cps unless otherwise noted

Features								Paper		Interface		
Bi-directional Printing	Vertical Tabbing	Graphics	Expanded Font	Compressed Font	"Paper Out" Alarm	Self Test	Other	Handling Method	Paper Types	Type	Speed (Baud)	Price
n/d	Yes	n/d	n/d	n/d	n/d	Yes	n/d	n/d	n/d	Serial Parallel	n/d	$1,895
Yes	Yes	n/d	n/d	Opt	Yes	Yes	n/d	Tractor	Fan fold	Serial Parallel	75-9600	$2,045
n/d	n/d	Yes	n/d	n/d	n/d	n/d	n/d	n/d	n/d	Serial Parallel	n/d	$2,295
Yes	n/d	Yes	n/d	n/d	n/d	Yes	Double pass	Friction	Fan fold, Sheet	Serial Parallel	110-9600	$2,995
Yes	Yes	No	Yes	Yes	Yes	Yes	Double pass	Tractor	Fan Fold	Serial Parallel	300-9600	$2,495
Yes	n/d	Yes	n/d	n/d	n/d	n/d	1K-character buffer	n/d	Roll, Fan fold, Cut sheet	n/d	n/d	$749
n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	Sheet Roll	Apple Atari TRS-80	n/d	$299
Yes	Yes	No	No	No	Yes	Yes	256-character buffer	Friction, Tractor	Sheet, Fan fold	Serial	110-1200	$3,055
Yes	No	Yes	Yes	Yes	n/d	n/d	Short line seeking	Friction, Tractor	Fan fold, Sheet	Serial Parallel	to 1200	$649
Yes	n/d	n/d	n/d	n/d	n/d	n/d	n/d	Friction	Fan fold, Sheet	Serial Parallel	n/d	$1,500
n/d	n/d	n/d	Yes	n/d	n/d	n/d	n/d	n/d	Fan fold	Serial	110-9600	$5,695
Yes	Yes	No	No	Yes	n/d	n/d	256-character buffer	Sprocket, Friction	Roll, Fan fold	Serial Parallel	300-9600	$1,299
Yes	Yes	Yes	n/d	n/d	Yes	Yes	Plotting	Friction, Tractor	Sheet, Fan fold	Serial	110-9600	$2,630
n/d	n/d	Yes	Yes	Yes	n/d	Yes	256-character buffer	n/d	n/d	Serial	n/d	$995
No	No	Yes	No	No	No	No	n/d	Sprocket	Fan fold	Serial Parallel	to 600	$399
Yes	n/d	Yes	Yes	Yes	n/d	Yes	Shortest print path	Friction, Tractor	n/d	Serial Parallel	n/d	$495
Yes	n/d	No	Yes	No	Yes	Yes	256-character buffer	Tractor	Fan fold	Serial Parallel	110-9600	$1,695
Yes	n/d	n/d	n/d	n/d	n/d	n/d	256-character buffer	n/d	n/d	n/d	110-600	$1,565
Yes	Yes	n/d	n/d	n/d	Yes	Yes	256-character buffer	n/d	n/d	Serial	110-9600	$1,895
n/d	Yes	n/d	Yes	n/d	Yes	Yes	112-character buffer	n/d	n/d	Wang	n/d	$2,900
Yes	Yes	Yes	n/d	n/d	n/d	n/d	n/d	n/d	n/d	Wang	n/d	$4,500
n/d	n/d	n/d	n/d	n/d	Yes	Yes	Bold face	n/d	n/d	Parallel	n/d	$2,650

Micros Approach Mini Capability: Bridging the Gap

by Terry Benson, Tom Fox
and Ralf Korbner

This comparison originally started as an evaluation of minicomputers, but our investigation revealed that many microcomputers have approached—and in some cases exceeded—the capabilities of some minis.

For the purposes of this comparison, we defined *high capability* micros as computer systems aimed primarily at small business applications that incorporate a microprocessor chip or chips. To be included here, the microprocessor had to offer either 16 bits, or two or more 8-bit microprocessors had to be connected in a multiprocessor environment. Nearly all of the systems will support multiple users operating simultaneously. The accompanying charts provide the pertinent specifications. Some systems are produced by manufacturers that have offered microcomputer products in the past, and other by traditional minicomputer and large scale/mainframe manufacturers.

It appears that the goal of these companies is to provide a high capability system at a low cost. While some of the companies even estimate a sales dollar range that would justify their particular product, it is up to the user to evaluate the system capabilities and his own business requirements to determine which business system would be most appropriate. Since prices range from about $5,000-23,000 for minimum systems and up to as much as $120,000 for a full system, it becomes very important to evaluate *all* parameters.

While several significant parameters should be evaluated for any system, there are two specific ones that should be considered when evaluating the high-capability systems. First is the number of terminals or users that can be accommodated, either through the basic system or with the capability to add additional users in the future. The second consideration is the amount of data storage that can be provided. In many cases, the high capability storage provided with either Winchester or cartridge disks is optional, but at least you will know that the capability exists in the future to accommodate your business growth requirements.

While most of the systems include the Basic language as a standard part of the package, some offer higher performance languages as an option and most provide optional software for several popular languages. In addition to software language capability, many manufacturers are or will be offering application packages to support the small business user. Some software houses not necessarily affiliated with the manufacturers will also be providing application packages and languages compatible with some of the more standard microprocessor devices and operating systems.

While every attempt was made to include all manufacturers that are using the popular 16-bit microprocessors (Intel 8086, Zilog Z-8000, Motorola 68000 and TI 9900), we probably missed a few systems. While the information is as accurate as we could ascertain, there may be some final questions that will need to be answered by the manufacturer.

The following summaries are included as an aid in reading the charts and to provide additional information that may not be apparent in the tables.

As in our past comparisons, we checked with each manufacturer to get the most recent information and to verify the characteristics of each system. In many cases, a particular feature or option was not available (n/a) directly from the manufacturer, although it is often available from outside sources.

Alpha Micro's *AM-1021*

We begin with one of the pioneers in the super micro class. Since 1977, Alpha Micro has produced a host of variations on a unique theme that marries the S-100 bus with a powerful 16-bit microprocessor that is a close cousin to Digital Equipment Corporation's LSI-11 chip set. Although more commonly seen as equipped with an entourage of 10- or 90-Mbyte cartridge-style hard disk drives, this month's charts describe Alpha's newest system—an 8.5M-byte Winchester hard disk model. A single double-density, double-sided floppy disk drive is provided for making data backups.

Although the modest accessing speed limits practical usage to three simultaneous users, the system is built of the same processing hardware and operating system that is ultimately able to support up to 24 terminals, including a number of printers.

Avid Alpha advocates point to the rich multi-user operating system as being this computer's most endearing feature. In addition, the system is equipped with a variety of languages (including a semi-compiling Basic and Pascal) that are uniquely suited for business applications. Applications software includes the big five: accounts payable, accounts receivable, payroll, order entry/inventory control and general ledger. In addition, Alpha's growing network of retail dealers has developed a variety of special-purpose packages for specific industries.

Convergent Technologies' *CT-2200*

This system is distinctive because of its radically different design and its manufacturer's pronounced attention to production quality and customer support.

The system itself is nearly unrecognizable as a computer. The basic unit consists of five distinct boxes connected together by cables or articulated swivel joints. There is a detachable keyboard with a generous length of cord that disappears into a thin table-mounted plastic slab. On top of this are the major elements of the computer: a CRT display terminal on the left and what looks like a matching vertical copy stand on the right. A slim vertical stand on the floor completes the equipment list; it contains the disk drives, power supplies and electronics.

The CTOS operating system ranks with the most sophisticated available. It is designed to be modular; a given implementation may use only that portion of its capabilities that are meaningful in a particular instance.

A set of programming tools for assembly-language programmers is included, featuring editor, assembler and linker programs.

The stand-alone system is priced at $20,000, including 256K bytes of RAM, a 10M-byte Winchester disk drive and 500K-byte floppy disk drive for backup purposes.

Data General's *Enterprise 1000*

The Enterprise 1000 marks a change in direction for Data General Corp., which has been producing minicomputers for over a decade. Although the company has offered a microprocessor—the Micro Nova—for several years, this is the first system that is really intended for the small user.

The unit is an integrated system that will be offered through independent office product dealers. There are 64K bytes of user memory *plus* an extra 4K by 12 block of RAM dedicated to the screen. The 150 cps printer,

included with the system, offers bidirectional printing with a 9 by 9 dot matrix. The diskette capacity is fixed at 716K bytes.

Enterprise/OS is the operating system specifically written for this system, but said to be compatible with other Data General systems. This should make it easier to operate the existing volumes of software for the Nova computers. Basic is standard with the Enterprise 1000, but there is an optional Business Basic package available for $300. The only application packages presently available are accounts receivable and inventory control at $1,000 each.

Hewlett-Packard's *HP9826A*

Although not designed as a general purpose small business computer, the 9826A has many of the capabilities of any of the other systems reviewed. We could safely say that the 9826A is aimed at the engineer who wants a desk top computer—and many of the small business computers are ending up in that same spot. Another reason to justify the inclusion of the 9826A is that it is the only system in our comparison that uses the Motorola 68000.

The 9826A is truly a stand-alone unit with no mass storage peripherals offered—although an external pair of floppies can be added when using the HPL operating system. The integrated screen, although smaller than most terminals, provides easily readable characters and a complete graphics capability.

Since the system is directed at the instrument control market, an integrated IEEE-488 bus provides a convenient method of interfacing to external equipment. Up to four additional I/O cards can be added to the system, or without any additional I/O, an unheard-of ½ Mbyte of RAM can be added to the system.

The user can select either Basic or HPL when ordering the system and application software packages can be translated from previous models. The company expects VisiCalc availability in the near future.

Intertec Data's *CompuStar*

The CompuStar is probably the least expensive starter system with the potential for operating in one of the most powerful multiuser systems. While the terminal (called a Video Processing Unit—VPU) is not based on a 16-bit microprocessor, it does use two Z80s within each VPU. In fact, you may even recognize the VPU as looking much like Intertec Data Systems' SuperBrain (IA Jun 80).

The low cost ($3,995) of the stand-alone terminal (model 20 VPU) with integrated dual floppies makes this attractive for any small business considering a computer system. Using the "shared resource" scheme of networking, up to 255 users can share a common disk device and data bases. Individual VPUs without integral floppies are also available as the model 10 VPU at $2,495. With any of the VPUs, programs can be downloaded from the disk device with a minimum of 10 Mbytes at $4,995.

Software support is very extensive, largely due to the CP/M operating system. There is also a utility

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package that allows the user selective access to the mass storage devices and even provides file protection capability. A large collection of application software is offered through Peachtree Software.

Lazor Systems' *Lazor-5*

The Lazor-5 is the starter system in a family of 16-bit small business computers. The basic system consists of 128K of memory and 2.4M-byte floppy storage. Additional peripherals can be added to allow up to 16 users access to up to 96 Mbytes of disk data.

The product line was described in detail in IA (Jun 80) where some of the key features of the hardware (I/O processors and interrupt structure) and software (MLX multi-task operating system) were pointed out. One other key feature not available in many small systems—nor even in most minis—is ECC (memory error checking and correction). This feature will minimize problems in the computer operation due to memory failures and enhance system reliability beyond that offered in all but the largest systems.

The Basic compiler offers the most extensive implementation of Basic available for 8086 processors. The company also offers a Cobol compiler that is a high-level implementation of the ANSI 74 Cobol standard. The application programs combined as a system turnkey package with hardware makes systems such as the Retailer practical for the small retail store.

Mercator's *MBS 3000*

The MBS 3000 is one of the first products to incorporate Intel's 8088—the half-brother to the 8086, yet still a 16-bit CPU. It also incorporates Intel's Multibus (or at least, the company claims that the system is multibus compatible). Although offered on a table top configuration, it is also offered in a rack mount version.

The basic system includes a 10M-byte Winchester, a 160-cps printer and two terminals. A total of four terminals and up to 40 Mbytes of disk storage—20 Mbytes in the basic chassis—can be configured for the maximum system. If more capacity is required, the MBS 4000 can support up to eight users. With 12K RAM, 20M-byte disk, and 300-lpm printer and six stations, the MBS 4000 lists for $45,100.

The operating system is actually the company's Basic, which is a customized business version. No other languages are supported. While a word processing system is not offered, an extensive array of application programs is available. In addition to the traditional accounting packages, which operate either independently or interactively, specialized programs are also available, e.g., sales order entry, job cost accounting and medical and dental packages. IDOL is the optional data base management software package.

Micro Five's *Series 3000*

This newest small business computer system from Micro Five (formerly Micro V) offers an integrated system in a convenient package for desktop mounting. The package is only 13 in. by 18 in. by 25 in., yet contains the complete processor, 128K bytes of RAM, floppy diskette (1.2M-byte) and 10 Mbytes of Winchester.

When comparing this system with others, don't stop at the basic system price—the $18,000 *includes* the above items. Most other systems allow the user to start out small and build up to a larger capacity system with typically larger desk or floor space required. This unique integrated package makes it attractive for the *small* business, especially if higher performance can be justified on the initial purchase. Micro Five has learned from experience on its previous systems, Microstar I (IA Jun 80) and Microstar II (also a 16-bit CPU), that users want to be able to upgrade their software and that commitment is extended into the series 3000 and beyond.

The software packages, supported by the STARDOS operating system, offer a wide variety of business applications. There are even some less popular application packages (e.g. florist accounting and travel agency management) in the library of dealer-developed software programs.

Micromation's *Mariner*

Although the Mariner is based on a 4MHz Z-80A microprocessor, the multi-user network configuration pushes the overall system capability up into the high performance range. Up to eight terminals can be connected in the master/satellite configuration by the addition of a slave processor board for each terminal or user.

Micromation's M/NET is the concept behind the satellite system configuration. This approach allows a user to start with the basic system ($4,500) and add additional user stations as the demands on the system expand. The second user can be added to the Mariner for $3,600 plus a terminal and each additional user, up to a total of eight, requires only the addition of one card selling for $1,300.

The choice of operating systems include not only the almost standard CP/M or MP/M but also the company's own AMDOS, which is compatible with CP/M and has a built-in data base management system, providing capabilities usually found only on larger mainframe computers.

The company also offers a rack mount version called the M/System; it sells for about $1,500 less than the Mariner, which is supplied in a futuristic cabinet.

Piiceon's *Model 1000*

The model 1000 is a powerful intelligent terminal with stand-alone capability. Don't let the price deter you from investigating this system further. One key advantage, whether you regard this as simply a terminal or a computer, is the screen size. Piiceon considers itself to be the "full page screen computer manufacturer" and the result is a 66 line by 80 column *full* screen—ideal for word processing applications. The user can even double the character size and have 33 lines per screen.

The keyboard is a 107 key multifunction "soft" key keyboard. This means that the user can define the functions of some keys, as required by a particular application.

The model 1000 includes two RS232 serial ports, a Centronics compatible parallel printer port and a built in modem interface.

The present operating system is CP/M 86, but a multi-user operating system is anticipated. The programming languages are generally available from software houses. A Basic compiler (CBasic) not available on many systems is also offered.

A word processing system is also anticipated, but the company has not yet committed to any applications programs. However, there should be several CP/M-

based applications available that will operate on CP/M 86. This looks like an ideal system for any business considering word processing requirements.

Rexon's *RX30*

The Rexon RX30 multi-terminal system is backed up by a company that is firmly dedicated to all the aspects of computer merchandising—hardware, programs, nationwide service, documentation and technical training serminars—that are vitally important considerations when making a computer purchase.

A basic single-user system consists of a central station in a 38-in. high cabinet, a CRT terminal and a printer. It is possible to support up to three additional CRT terminals and a second printer. The central station consists of a metal cabinet topped by a (nearly) 20M-byte dual-platter hard disk drive. The front of the cabinet swings open for access to a vertically mounted 6-slot mother board. Plugged into the board are the Executive Processor card, a Memory Module card, a Disk Controller card and a Device Adaptor card to connect up to four CRT terminals and two printers. Space remains for both an additional Memory Module and Device Adaptor card.

Each system includes a copy of Recap, a combination disk operating system, Basic language and utilities package.

The $35,000 price includes a two-terminal RX30 with 64K bytes of memory, a 20-Mbyte disk drive and T1810 printer. Also included are installation, training and customer support. All of the Rexon-supplied software, including Idol (Interactive Definition-Oriented Language), a tool for writing certain types of data base manipulating applications programs, round out the package.

Symcro Systems' *SB700*

The SB700 is another of the Z80A-based systems that provide a unique configuration of four or more microprocessors. While most multiprocessor arrangements dedicate each processor to a specific task (terminal, floppy, communication, etc.), the SB700 allocates tasks to any available processor through the hardware polling controller. Although the architecture allows the system to be expanded to 256 processors, the largest yet configured has been with 40 processors.

In order to manage the multiprocessor system controller, Symcro developed a system management software package dubbed MSL (Modular System Logic). MSL is a concept based on the same approach used in some of the large mainframe computers. Thus with MSL, each user can operate his own CP/M, yet have complete access to the system resources. A utility package, Easy Run, allows the user to *easily* integrate CP/M application programs from a wide variety of other vendors into a more homogeneous operating package.

The minimum system supports two users, but it can be expanded to 24. If you want to purchase a complete two-user system with two terminals and a 150 cps printer, you will pay $24,975. When comparing prices, don't forget that the basic system also includes 10M bytes of hard disk storage and a 1M-byte floppy.

The application software packages include all of the standards in addition to an improved Wordstar package and custom accounting packages. Specific packages are also offered for the construction industry, the legal profession, manufacturing, retail sales and others.

Technico's *T.I. 32*

This powerful system is based on TI's 9900 CPU. Technico has been offering a family of products with the 9900 for a number of years—primarily for the industrial market. (IA reviewed the SS-16 in Feb 80.)

Technico's experience in both extensive hardware support for its earlier products and the comprehensive software has carried over into this system. The key feature is the power offered by the dual 16-bit CPUs (hence the "32" in the model name). The dual processors enhance multi-user and multi-tasking applications and provide a much higher throughput for all applications.

One potential disadvantage of the 9900 is the shortage of standardized software packages. The company has solved this by offering its high performance software package for all types of small (and large) business applications. In particular, the extended Boss Basic II is similar to compilers used on the DEC System 10 and the Honeywell 6600.

The reasonable single user price ($8,999) or even the multi-user system price ($9,999) makes this a very attractive system for the small business that expects to grow into a larger system in the future.

TEI's *System/48*

The first major system offered by this traditionally component-oriented manufacturer is a solidly executed business micro, highlighted by a multiprocessing system.

The basic system consists of a single pedestal-like enclosure containing two microcomputers, a separate printer in a low-boy cabinet and a single CRT terminal. The micros work together to share the overall computing load for a number of simultaneous jobs or users.

Each of the micros runs with its own resident copy of Magic, the company's proprietary operating system. It occupies about 18K bytes of the available 64K RAM space on each card, and can be described as a "CP/M lookalike," at least at the operator interface level. The operating system was designed so that many of the thousands of available CP/M-compatible programs will run on the sytem without modification—at least those programs that adhere to normal CP/M rules.

The basic system, complete with 18M-byte hard disk, 1M-byte floppy, a master processor and one for applications (each with 64K bytes of RAM), a 150-cps printer and single CRT terminal, lists for about $22,000. The price also includes the operating system, DBMS, two Basics, two editors and some hardware diagnostics programs.

Texas Instruments' *DS 990 Model 1*

Texas Instruments has aimed the DS990 series at the OEM. But with the company's large customer base and name recognition, the end user market is also a target. The company has used its own TMS 9900 16-bit microprocessor in the DS 990.

The DS990 model 1 is a single user system that can be upgraded to a multiuser DS990 model 2. One of Texas Instruments' thermal printers can also be integrated into the system or any external printer can be used. No disk other than floppies can be added.

The optional operating systems can provide Cobol capability (DX5) for $1,200 or can support other languages (TX5) for $1,700. While Cobol is included with DX5, Basic ($800), Fortran ($1,200) and Pascal ($2,400) are available for operation with TX5. □

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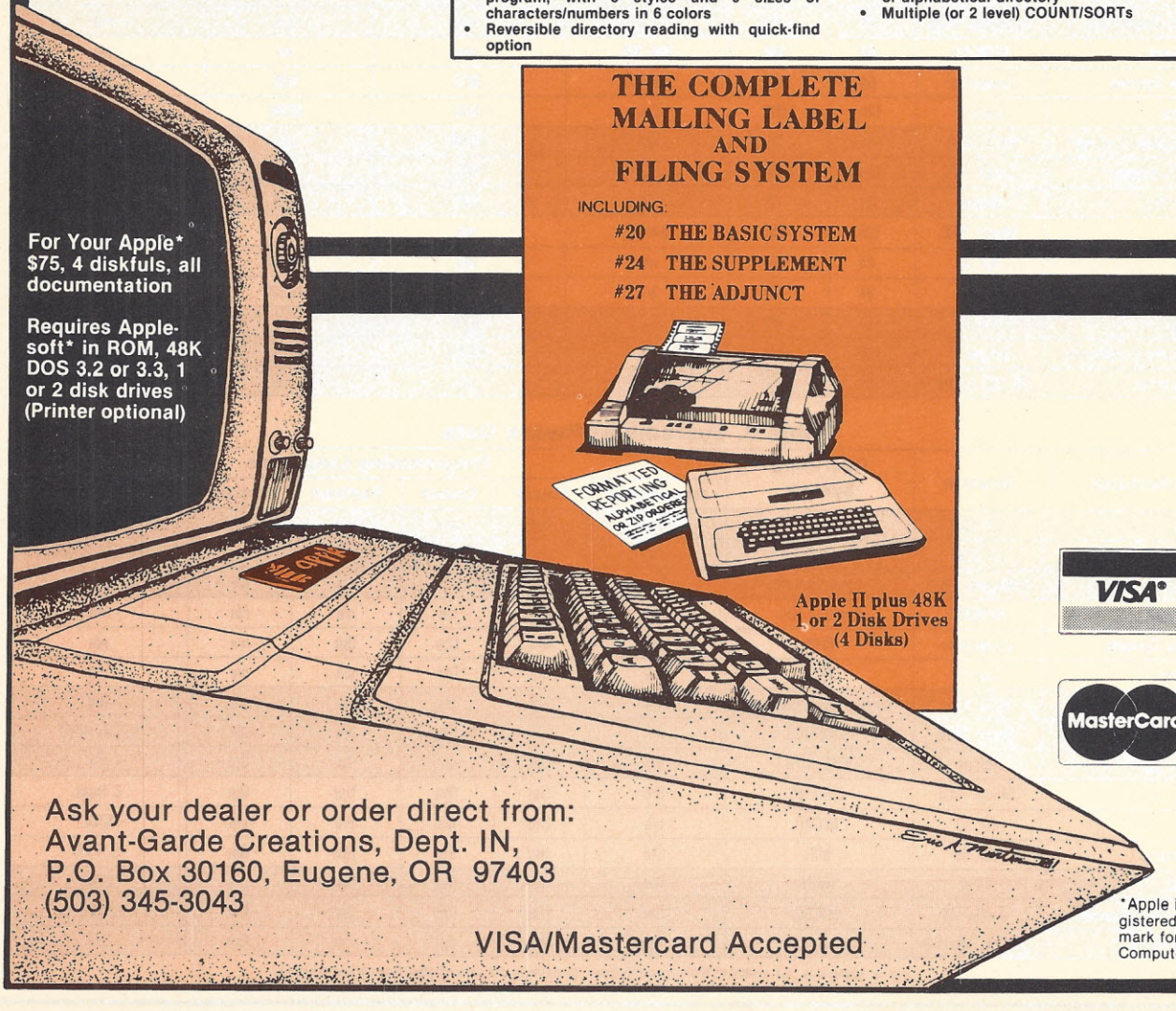

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Table 1. Hardware Data

Manufacturer	System	Price	Enclosure			CPU			Bus	Peripherals (std/opt)	
			Table Top	Desk	Floor Mount	Type	Multi-processor	Bits		Terminal	Printer
Alpha Micro	AM 1021	$14,000	Std	No	Opt	WD-16	No	16	S-100	0/3	Opt
Convergent Technologies	CT-2200	20,000	Std	No	Std	8086	yes	16	CT-Bus Multibus	1/16	none
Data General Corporation	Enterprise 1000	7,195	Std	No	No	mN 602	No	16	n/a	1/1	Std
Hewlett-Packard	HP9826A	8,950	Std	No	No	68000	No	16	Proprietary	1/1	Opt
Intertec Data Systems	CompuStar	3,995	Std	No	No	Z80	Yes	8	Proprietary	1/255	n/a
Lazor Systems	Lazor-5	13,670	Std	Opt	No	8086	No	16	Proprietary	0/16	Opt
Mercator Business Systems	MBS 3000	21,000	Std	n/a	n/a	8088	No	16	Multibus	2/4	Std
Micro Five Corporation	Series 3000	18,000	Std	No	Opt	8086	No	16	None	0/10	Opt
Micromation Inc.	Mariner	4,500	No	No	Std	Z80	Yes	8	S-100	0/8	Opt
Piiceon, Inc.	Model 1000	11,335	Std	n/a	n/a	8086	No	16	n/a	1/1	n/a
Rexon	RX 30	22,900	No	No	Std	8086	No	16	Proprietary	0/8	Opt
Symcro Systems	SB-700	18,465	n/a	n/a	Std	Z80	Yes	8	Proprietary	0/24	Opt
Technico Inc.	T.I.-32	8,999	Opt	Opt	Std	TMS 9900	Yes	16	Proprietary	0/6	Opt
Texas Electronic Instruments	System 48	22,000	No	No	Std	8085	Yes	8	Proprietary	1/8	Std
Texas Instruments	DS 990 Model I	9,995	Std	n/a	n/a	TMS 9900	No	16	Proprietary	1/1	Opt

Table 2. Memory/Storage Data

Manufacturer	System	RAM (Kbytes)		Disk Drive (Mbytes)			
		Std	Max	Floppy Std/Max	Winchester Std/Max	Cartridge Std/Max	Cassette Tape
Alpha Micro	AM 1021	128	512	1.2/6	8.5/34	0/360	n/a
Convergent Technologies	CT-2200	256	16,000	0.5/8	10/480	n/a	n/a
Data General Corporation	Enterprise 1000	64	64	.716/.716	n/a	n/a	n/a
Hewlett-Packard	HP9826A	64	504	.264/.264	n/a	n/a	n/a
Intertec Data Systems	CompuStar	64	64	.350/1.5	0/10	0/96	Opt
Lazor Systems	Lazor-5	128	1,000	2.4	0/40	0/384	Opt
Mercator Business Systems	MBS 3000	64	128	n/a	10/40	n/a	Std
Micro Five Corporation	Series 3000	128	1,000	1.2	10/54	n/a	Opt
Micromation Inc.	Mariner	64	64	0/4	0/21	n/a	Opt
Piiceon, Inc.	Model 1000	128	750	2.4/4.8	n/a	n/a	n/a
Rexon	RX 30	64	256	n/a	n/a	20/40	n/a
Symcro Systems	SB-700	64	64	1/1	0/20	10/300	Opt
Technico Inc.	T.I.-32	64	192	1.2	0/116	n/a	Opt
Texas Electronic Instruments	System 48	128	576	1/2	20/266	n/a	Opt
Texas Instruments	DS 990 Model I	64	64	2.3/4.6	n/a	n/a	n/a

Table 3. Systems Software Data

Manufacturer	System	Operating System	Programming Languages					
			Assembler	Basic	Cobol	Fortran	Pascal	Others
Alpha Micro	AM 1021	AMOS	Std	Std	n/a	n/a	Std	LISP, SORT, ISAM
Convergent Technologies	CT-2200	CTOS	Std	Opt	Opt	Opt	Opt	ISAM, SORT, Comm.
Data General Corporation	Enterprise 1000	Enterprise/OS	n/a	Std	n/a	n/a	n/a	Business Basic
Hewlett-Packard	HP9826A	Basic or HPL	n/a	Std	n/a	n/a	n/a	HPL
Intertec Data Systems	CompuStar	CP/M	Std	Opt	Opt	Opt	n/a	n/a
Lazor Systems	Lazor-5	MLX	n/a	Opt	Opt	n/a	n/a	n/a
Mercator Business Systems	MBS 3000	Custom Business Basic	n/a	Std	n/a	n/a	n/a	n/a
Micro Five Corporation	Series 3000	STARDOS	n/a	Std	Opt	n/a	n/a	ISAM, SORT
Micromation Inc.	Mariner	CP/M, MP/M	Opt	Opt	Opt	Opt	Opt	n/a
Piiceon, Inc.	Model 1000	CP/M 86	Std	Opt	Opt	Opt	Opt	C Basic
Rexon	RX 30	RECAP	n/a	Std	n/a	n/a	n/a	IDOL
Symcro Systems	SB-700	MSL	Std	Std	Opt	Opt	Opt	C, PL/1
Technico Inc.	T.I.-32	TMOS	Opt	Opt	Opt	Opt	n/a	ISAM
Texas Electronic Instruments	System 48	MAGIC	Std	Std	Opt	Opt	Opt	ISAM
Texas Instruments	DS 990 Model I	Opt	Opt	Opt	Opt	Opt	Opt	n/a

n/a = feature is not available from manufacturer; in several cases available from other sources.

Table 4. Applications Software Data

Manufacturer	System	Word Processing	DBMS	General Ledger	Accounts Payable	Accounts Receivable	Payroll	Inventory Control	Others
Alpha Micro	AM 1021	Std	n/a	Opt	Opt	Opt	Opt	Opt	n/a
Convergent Technologies	CT-2200	Std	n/a	n/a	n/a	n/a	n/a	n/a	Forms design, Font design
Data General Corporation	Enterprise 1000	n/a	n/a	n/a	n/a	Opt	n/a	Opt	n/a
Hewlett-Packard	HP9826A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Engineering
Intertec Data Systems	CompuStar	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lazor Systems	Lazor-5	Opt	n/a	Opt	Opt	Opt	Opt	Opt	Purchase property manager, Real estate
Mercator Business Systems	MBS 3000	n/a	Opt	Opt	Opt	Opt	Opt	Opt	Medical, Sales order entry
Micro Five Corporation	Series 3000	Opt	Std	Opt	Opt	Opt	Opt	Opt	Mail list
Micromation Inc.	Mariner	Opt	Std	n/a	n/a	n/a	n/a	n/a	n/a
Piiceon, Inc.	Model 1000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rexon	RX 30	Opt	Std	Opt	Opt	Opt	Opt	Opt	Sales order, job cost
Symcro Systems	SB-700	Opt	Opt	Opt	Opt	Opt	Opt	Opt	n/a
Technico Inc.	T.I.-32	Opt	Opt	Opt	Opt	Opt	Opt	Opt	Mail list
Texas Electronic Instruments	System 48	n/a	Std	Opt	Opt	Opt	Opt	Opt	Property management
Texas Instruments	DS 990 Model I	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 5. Corporate Data

Manufacturer's Address	Gross Sales	When Established	Dealers		Service Centers		System's First Delivery
			U.S.	Foreign	U.S.	Foreign	
Alpha Micro Systems 17881 Sky Park North Irvine, CA 92714	21 M	1977	170	24	29	24	1977
Convergent Technologies 2500 Augustine Dr. Santa Clara, CA 95051	10 M	1979	24	1	210	1	October 80
Data General Corporation Route 9 Westboro, MA 01581	654 M	1969	130	n/a	150	n/a	September 81
Hewlett-Packard 3404 E. Harmony Rd. Fort Collins, CO 80525	3.1 B	1939	102	75	102	75	June 1981
Intertec Data Systems 2300 Broad River Rd. Columbia, SC 29210	18 M	1973	400	30	n/a	30	February 81
Lazor Systems Inc. 1050 E. Duane Ave. Sunnyvale, CA 94086	n/a	1978	20	15	20	15	September 80
Mercator Business Systems 1294 Lawrence Station Rd. Sunnyvale, CA 94086	7 M	1979	12	25	9	25	April 81
Micro Five Corporation 17791 Sky Park Circle Irvine, CA 92714	n/a	1977	60	15	60	15	May 81
Micromation Inc. 1620 Montgomery St. San Francisco, CA 94111	1 M	1977	20	50	1	50	October 79
Piiceon, Inc. 2350 Bering Dr. San Jose, CA 95131	3.6 M	1977	11	4	n/a	n/a	March 81
Rexon Business Machines 5800 Uplander Way Culver City, CA 90230	1.5 M	1978	42	2	13	2	July 79
Symcro Systems 7300 Crescent Blvd. Pennsauken, NJ 08110	1 M	1977	3	1	7	1	April 1981
Technico Inc. 9051 Red Branch Rd. Columbia, MD 21045	n/a	1975	n/a	n/a	n/a	n/a	September 80
Texas Electronic Instruments Inc. 5075 S. Loop East Houston, TX 77033	n/a	1967	100	10	100	10	February 81
Texas Instruments P.O. Box 225012 Dallas, TX 75265	4.1 B	1930	41	n/a	45	n/a	April 1979

n/a = feature is not available from manufacturer; in several cases available from other sources.

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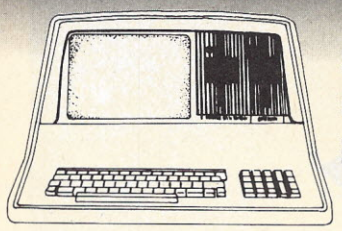

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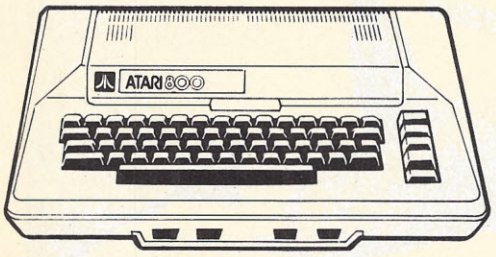

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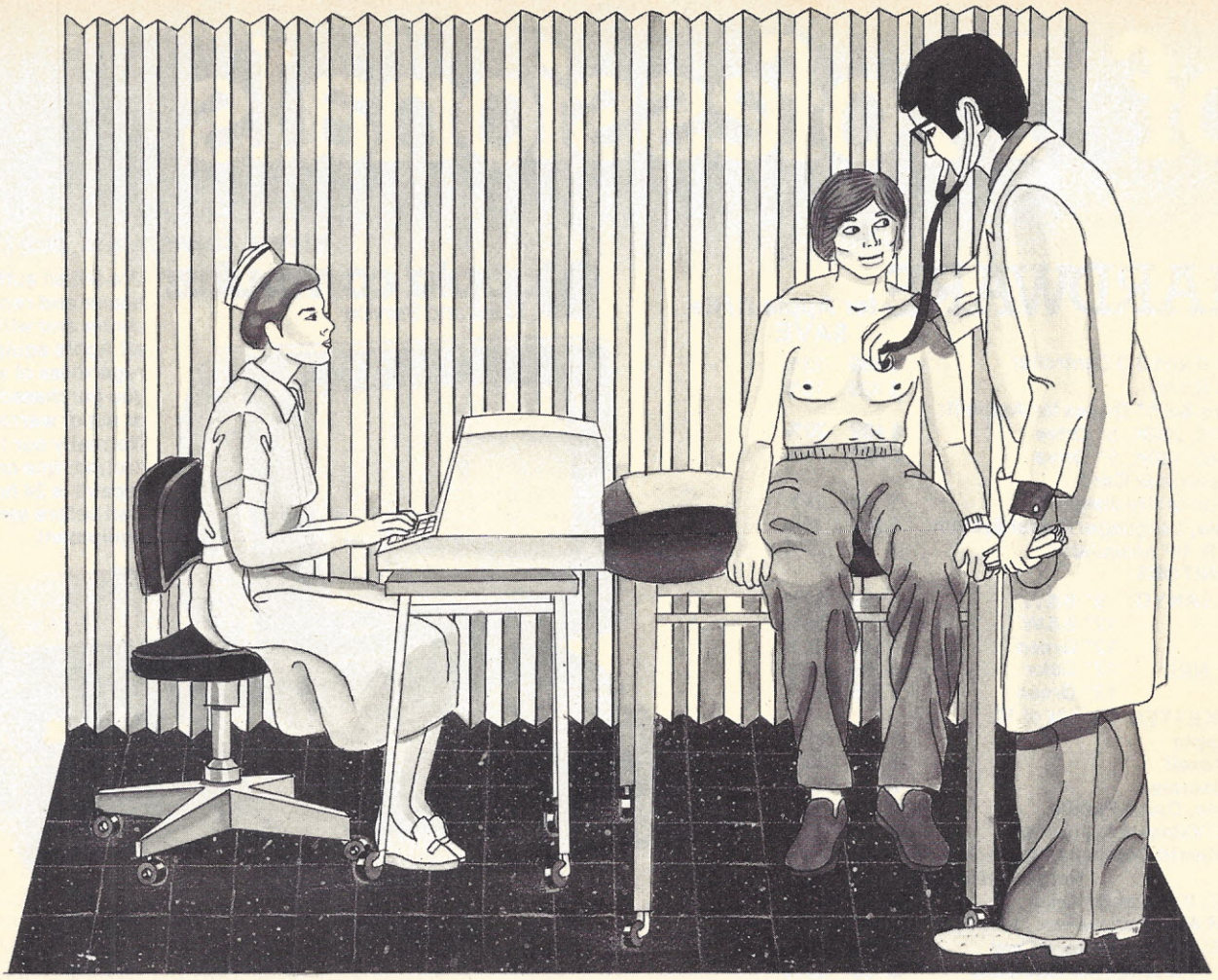


IMPLEMENTING HEALTH MAINTENANCE PROGRAMS

by Kevin M. Hepler, M.D.

After decades of emphasis on curing sickness, modern medicine is now directing its efforts toward the prevention of disease and maintenance of health as one of its primary goals. And there is a growing sense on the part of the health consumer to accept responsibility for his own health. It is worthwhile to examine the issue of health maintenance in the medical profession and to make suggestions of how computers might be used by the family practitioner in private practice to streamline this task.

The concept of the annual physical exam has now been widely accepted by the layman. Indeed, surveys of patient visits to physician's offices show that 10-20% of all visits to a general practitioner's office are for examinations in which the patient has no specific complaint suggestive of disease. Instead, he is looking for undetected disease, advice on how to prevent illness and reassurance from the physician that everything appears "normal."

However, there is great debate within the medical profession on what should take place during such a visit. Critical analysis has recently shown that the annual complete physical examination with its associated laboratory tests and X-rays is not effective in changing the outcome of many diseases. It also wastes medical resources. With the advent of modern technology and the improvement of laboratory methods, many common illnesses can be detected with simple tests. The process called screening involves the use of a basic procedure to examine large numbers of people for the existence of a given illness. Some common screening tests are skin tests for TB and the pap smear for cervical cancer in women.

Health maintenance also consists of immunization against infectious disease and health education efforts. Patients are taught to recognize symptoms of illness and to address controlling factors such as stress, alcohol abuse and smoking, which contribute to many major illnesses and deaths.

All of these interventions (screening tests, immunizations and health education) need to be performed during a visit for health maintenance. This group of interventions is often called the periodic health maintenance visit to distinguish this approach from the older idea of the annual physical exam.

While computerization would clearly streamline this procedure, the medical profession has been among the slowest disciplines to accept computers in day-to-day

practice. Many doctors, especially those working as part of a group practice, have moved toward computerizing their accounting systems. Many hospitals now have computer systems to keep track of laboratory data on patients. But the widespread use of computers to do actual diagnosis and management of patient problems is still a long way off.

Health maintenance programs could easily narrow this gap. The data are in a discrete form and easily handled by a computer. The information that needs to be maintained for each patient consists of a list of the screening tests and other health maintenance activities, the date and results of the last time this item was performed, and when it is due to be repeated. The manipulation of the required data involves capturing the data items, providing information to the physician or other health care worker when dealing with the individual patient, and making available various reports on the status of the program. This description of the operations involved is nothing more than that of data base management, a task already defined as well suited for a computer.

Most primary care physicians would like to implement health maintenance programs for their patients. Three factors act as barriers: fragmentation of medical care (whereby in our specialized system of medicine, no one doctor is primarily responsible for a given patient's overall health), patient resistance to such activities, and the lack of physician motivation.

This last item is indeed the most important barrier and arises for several reasons. The general practitioner's time is limited, and even if he did want to spend time on health maintenance, acutely ill patients take first priority. Health maintenance is not frequently rewarding, since many people must be examined to find the case of an illness. In terms of time, health maintenance activity produces less income than the more expensive workup of an existing disease. Cost to the patient is also an important factor. Finally, the work is tedious and requires close attention on the part of the physician to recognize when a given test is due and to make sure it is carried out and followed up.

Keep it simple

Guidelines to the doctor who wishes to set up a health maintenance program will help overcome some of these objections. First, he is advised to keep his effort simple to enable him to focus on the important issues. Next he needs to have an organized record system. Paramedical personnel can be used to carry out most of the routine work. There must be a system of checks to ensure that the system is being complied with, that patients are receiving the tests when indicated, and that positive results are followed up. Finally, there must be a means to analyze the program, using the data collected with a retrospective audit to determine how successful it has been and how it can be improved. A computer system would help with all of these aspects.

As an example of how this might be implemented, I was involved in developing such a system for the primary care clinic of a major southeastern university medical center. Here the department of information sciences had already developed a total computer information system that was used in the clinic. All record keeping activities in the course of patient care were computerized. In fact, the paper medical chart was almost extinct.

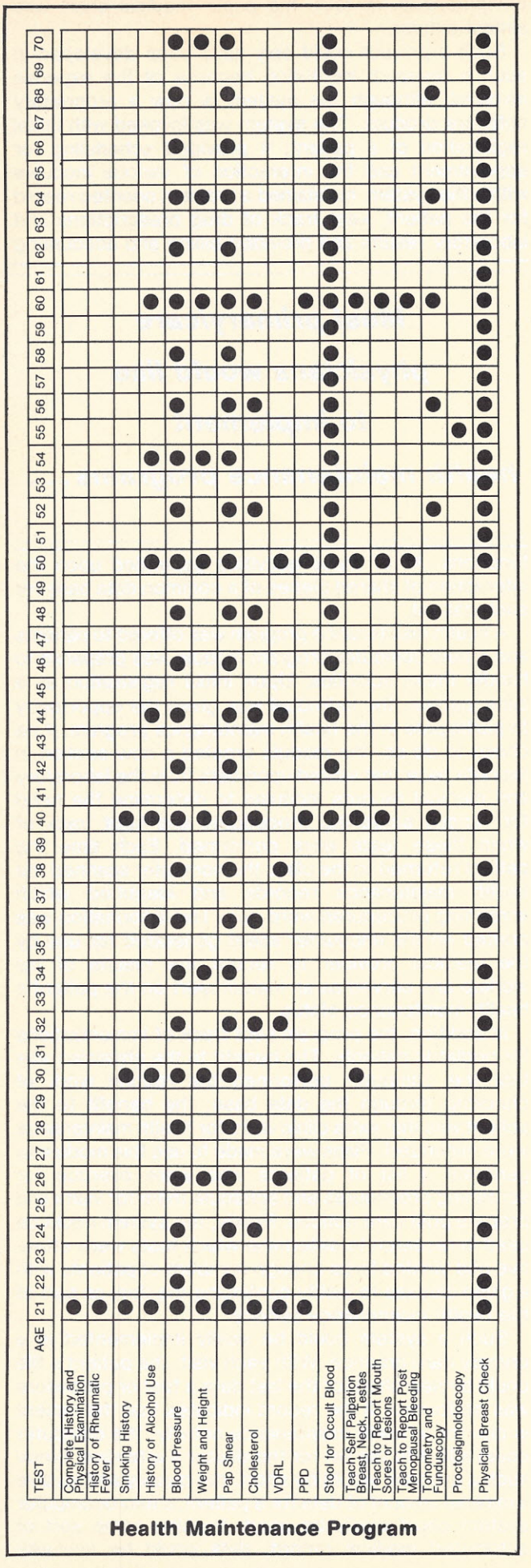
Such a project could only have been developed in such a research institution because of the expense involved, although the system is now a proprietary software product. The system was invoked with initial registration of a patient; it provided scheduling for appointment and the interaction of various modules within the system, maintained a problem oriented record for the patient, kept track of drug prescriptions and laboratory results and provided billing and accounting functions. All of these activities depended upon the interaction of shared pieces of a common data base for each patient.

Most primary/care physicians would like to implement health maintenance programs . . .

A health maintenance program was offered to patients and a new computer program module was prepared to handle these activities. Upon initial registration as a clinic patient, the individual was given the opportunity to participate in the health maintenance program. If he chose to do so, the module created a new section in his data base that seized upon data from the laboratory and medical records modules to determine the need for various screening procedures and kept track of when these tests were performed. Each time the patient returned to the clinic the computer scanned the health maintenance records and identified which screening procedures were due. This information was printed on the encounter sheet generated for use by the medical provider to record the results of his workup and served as an instant alert on the patient's health maintenance status.

In addition, the program kept track of immunizations for pediatric patients. The benefit to the physician was that the computer performed the routine work of checking through the data base; the benefit to the patient was that extra clinic visits for health maintenance were minimized. Plans were made to use this module to generate a list of patients who were overdue for screening procedures and schedule them for visits and prepare post card notices. Finally, the system could be used in research to determine which tests were effective and yielded large enough numbers of patients with a given disease to justify continuing the item as part of the health maintenance service.

Such a system could be easily implemented in a primary care practice. With each visit, the patient's file could be searched for the last date a test or procedure was performed. If the record indicates that the patient is due for a health maintenance activity, the computer could add it to the list for the doctor's attention. Since such a program would be short, run quickly and involve a minimal amount of data for a patient, a microcomputer system could easily be used. Lacking some sort of automated medical record, data could be manually



Health Maintenance Program

entered at the end of each visit. A one time charge to the patient at the time of registration would help defray the initial costs.

So far our discussion has involved only health maintenance activities for healthy adult patients. Obviously, a similar protocol could be developed for children. In the university system described above, only immunizations were monitored. However, the concept of the healthy child visiting the pediatrician is well established and the guidelines for these visits could be used to develop a separate list of health maintenance items for children. Since the well child visits comprise a large portion of the total visits to the pediatrician's office, such a system would be extremely useful.

A basic computer-based health maintenance program operating on a list of interventions such as those defined in the accompanying table could be broadened to allow monitoring of patients with chronic health problems. Concerning a patient with a chronic disease such as diabetes, individual lab tests and health education efforts could also be followed if they are added to the basic list.

Such a system would be quite practical in the office of a specialist following many cases of a given disease. One way to implement this would be to include a flag for specific disease conditions with the patient identification in the computer record that would cause branching in the computer program to the proper list of special interventions. Such a program could grow quite elaborate with specific branching of various procedures or treatments depending on the patient's course. However, such a program would no longer be classified as a health maintenance effort. Instead, it would have become a computerized patient management system. Such programs have been developed on an experimental basis for such conditions as burn victims, hypertension, diabetic shock, liver disease and coronary care units. These are often quite elaborate and expensive to maintain and require physician monitoring of their activities.

Historical data significant

Another area where programs could be useful would be in monitoring individuals who are at higher risk for given illness on the basis of their family histories or on their own past medical histories. An example might be in cases of familial polyposis, where the patient's tendency toward forming polyps in the colon requires constant surveillance for cancer. Again, a computer system could be established that would allow customizing health maintenance protocol for each patient.

Finally, health maintenance programs could be used to generate a printed health maintenance history that could be given to the patient for his own use. This is related to the idea of a portable health history suggested for all persons to carry while traveling or when to provide important information to other doctors.

For the physician, the benefit of a computerized health maintenance program would be to free him from the drudgery. Computerizing health maintenance would make it more efficient, less prone to error and more easily monitored. The computer would become an instrument that would free the physician for the task which he initially sought when he began practicing medicine—namely the human interaction with his patients. □

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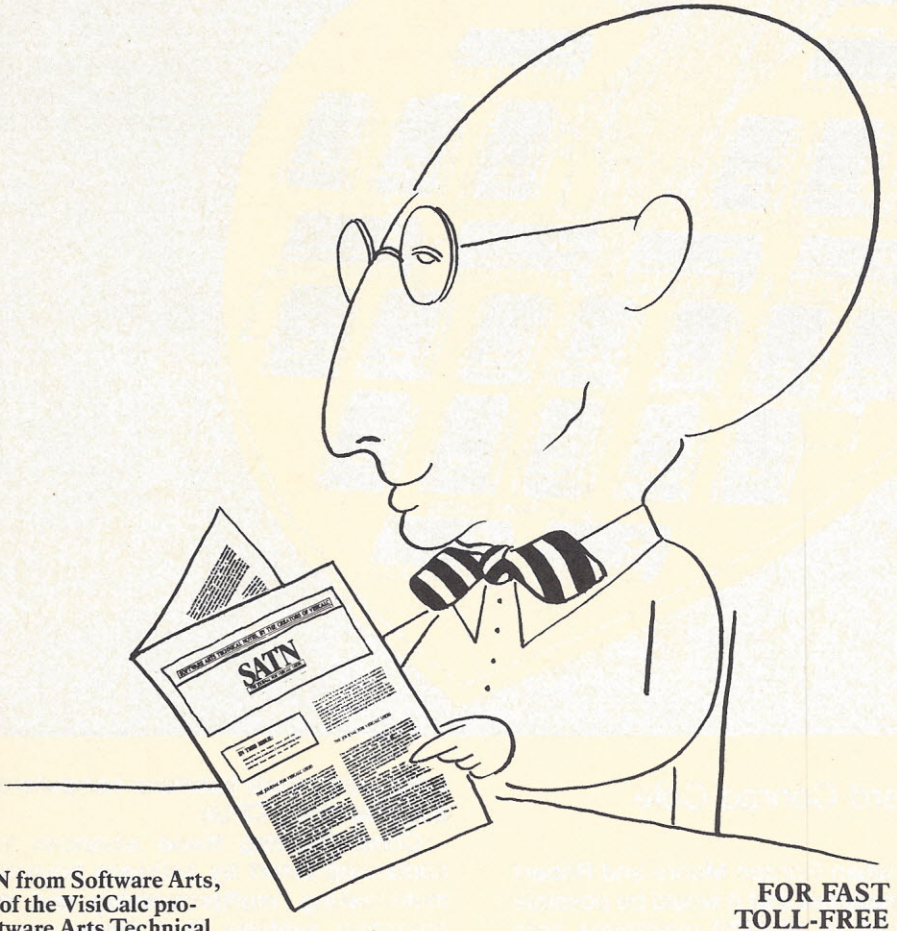

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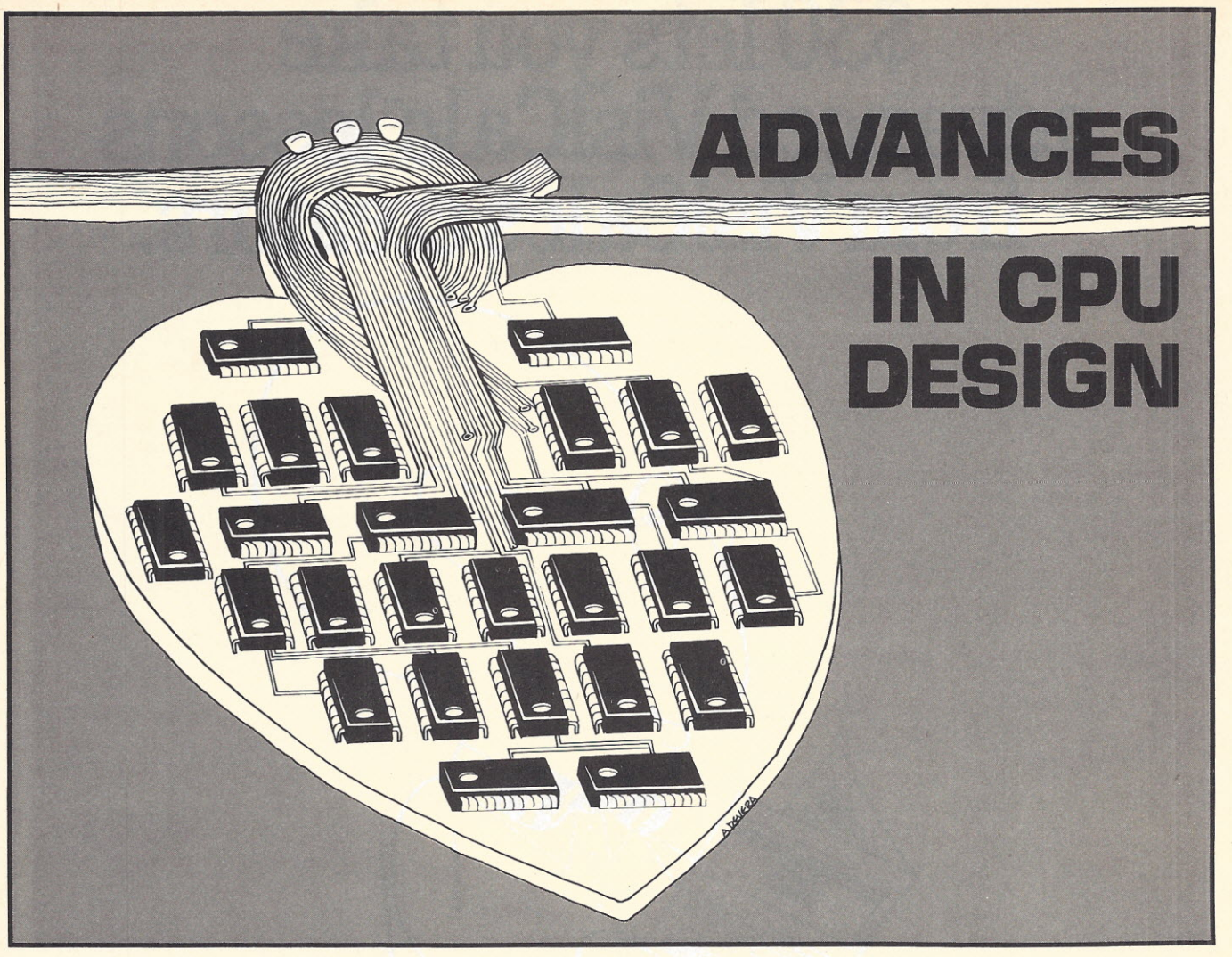


ADVANCES IN CPU DESIGN

by Bernard Conrad Cole

In the early 1970s, when Gordon Moore and Robert Noyce of Intel Corp. predicted that it would be possible to put the equivalent of an IBM370 mainframe onto no more than a few silicon chips by the end of the 80s, a lot of people laughed. The rest said it would take a little longer. Both are wrong, if new developments are any indication.

The introduction of prototype 256K bit dynamic RAMs, 1 to 4 Mbyte bubble memories and CPUs containing the equivalent of 450,000 transistors provides good examples. And these are still in the laboratory.

More exciting is the move from prototype to production of a wide range of new CPU designs, including: true 16-bit designs capable of accessing literally millions of bits of memory directly, equivalent in performance to many minicomputers; new 32-bit designs, still in development, designed specifically for high level computer languages and equivalent in performance to some mainframes; new hybrid 16-bit microprocessors, which are true 16-bit CPUs internally, but communicate with the outside world on an 8-bit bus; powerful single chip microcomputers, which, unlike the original I/O and control oriented CPUs, are designed for multiprocessing applications.

The impact of these new designs will be to erase, or at least blur, the distinction between personal/home computers, small business computers, minicomputers and mainframe CPUs.

Complementing these advances in hardware is a continuing effort by software houses to develop the multi-tasking, multiprocessing and multiprogramming operating systems that these new 16 and 32-bit designs will require.

Of all the new 16 and 32-bit processors, the oldest (except for TI's 9900) but simplest is the Intel 8086, an improved 16-bit version of the 8080. It incorporates an 8080 type multiplexed bus expanded to a 16-bit external bus, and, as in the 8080, the instructions are byte oriented. The 8086 has 95 basic instructions, of which a substantial number are only eight bits long. Since its instruction set is basically an expanded version of the 8080's, code from the latter can be converted easily to the former. Internally, the 8086 retains an 8-bit instruction path similar to the 8080's and the ALU is also 16 bits wide, similar to the 8080's. Thus the 8086 is a widened 8080 with enhanced addressing and instruction prefetch.

Taking another tack, the Z8000 is not an enhancement of the Z80 and has different internal structure. It is a true 16-bit machine with data and instruction paths, both 16 bits wide. Its instructions are either 16 or 32 bits long and the instruction set is word-oriented. A single 32-bit instruction is used for set and move operations, while in the 8086, single byte instructions must be used.

The MC68000 from Motorola has an external 16-bit bus multiplexed from an internal 32-bit bus, and supports 56 basic instructions and 14 addressing modes. The total number of instructions is misleading, however, because many instructions perform triple operations. Instruction sizes vary from one to five words.

In addition to these well-known devices, which are now entering high volume production and are being incorporated into systems, a wide range of other 16/32-bit designs are appearing on the market.

National Semiconductor, for example, has announced a family of 16-bit microprocessors called the NS16000 series, consisting of the NS16008, NS16016 and NS16032 processors. Of these, the 16008 and 16016 are very similar, offering an internal data bus 16 bits wide and a direct addressing range of 64K bytes. In addition, either can operate in two distinct modes: native mode, in which the two processors have 100 basic instructions and are directly compatible with the 16032; 8080 mode, which permits direct emulation of the 8080, with a speed four times that of the 8080.

The 16008 and 16016 are designed to bridge the gap between the 8080 and high end members of the 16000 family. The primary difference between the two is that the 16016 has a 16-bit data bus and the 16008 has only an 8-bit data bus and is primarily suitable for use in systems with 8-bit wide memories and peripherals. The NS16032 has an address range of 32 Mbytes and does not have an 8080 compatibility mode. The internal data bus is 32 bits wide.

Just announced from Intel is a new 3-chip 32-bit design that is aimed at challenging the performance of many large computers. Designated the iAPX-432 Micromainframe, it is made up of three devices. Two of them constitute a general data processor (GDP): the iAPX-43201, which fetches and decodes instructions and the iAPX-43202, which executes them. Together they form a 32-bit processing element that supports a logical address space of 2^{32} bytes. The memory architecture permits a virtual memory system address space of up to 2^{40} bytes, which extends well beyond that of most midrange mainframes.

Multiple processors

Its architecture allows the GDP to use higher level data types to improve the efficiency of instruction coding with high level languages such as Ada, a Pascal like language adopted as a standard by the military. Since the GDP is designed to operate with concurrent multiprocessing system structures, more processors can be added to a system without adding new instructions.

The third chip, the iAPX-43203, is an interface processor that provides attached processing capability to allow other processor products, such as Intel's 8086 or 8088, to be added to the system for specific job processing.

Another interesting design is a 32-bit CMOS microprocessor developed by Bell Laboratories. A register-based machine, its architecture is divided into two subunits, one optimized for fetching instructions, the other for executing them. Called the MAC-32, it features not only low power operation but is also fast, executing a 32-bit addition in just 60 nS. The instruction set is extremely rich, allowing all of its data types to be used with any instruction. Included are bit manipulation instructions that work not only on single bits, but on fields and blocks of data. Containing the equivalent of 100,000 transistors, the MAC-32 operates off a 32 MHz clock.

The most highly integrated logic chip ever produced is the 32-bit microprocessor from Hewlett-Packard, an NMOS device incorporating 450,000 transistors onto a single IC. It has a register-based architecture that incorporates a 28 by 32-bit file memory on-chip. It also contains several special purpose hardware units, including a hardware multiplier that yields a 64-bit result from two 32-bit operands in only 1.8 μS.

Powerful chip set

From Data General is a family of NMOS circuits that emulates the high end Eclipse minicomputer. Called the Micro-Eclipse, the chip set forms the basis of an entire spectrum of system configurations from compact single board implementations to high performance minis. The implementations include the S140, a small general purpose minicomputer; the S250, a larger machine capable of array and floating point processing and the C/350, a high end mini with floating point and instruction set extensions aimed at large data processing applications.

At the high end is the M600, a multiple function mainframe sized computer. The Micro-Eclipse family is based on a CPU chip that executes a kernel of the Eclipse C/350 instruction set and supports up to two Mbytes of memory. It can accept external microcode from one or more additional microcontroller chips (XMCs) to accommodate additional instruction set expansions. Another companion chip, the system I/O device (SIO) provides compatibility with both the Eclipse and MicroNova I/O busses, at the same time providing several internal peripheral instructions. The CPU, XMC and SIO devices are interconnected by a 16-bit parallel system bus. A dedicated 8-bit bus enables XMCs to transmit microcode to the CPU.

Another entrant in the advanced 16/32-bit race is Texas Instruments, with its TMS9995 and TMS99000 families, extensions of its almost decade old TMS9900 16-bit CPU. Supporting each of these advanced CPUs are a variety of coprocessors and slave processors, which provide specialized capabilities that are too expensive to integrate onto the CPU chip.

For example, the 8087 floating point math coprocessor is designed to perform all of the calculations according to the IEEE approved format. Similarly, National's slave processors, which include a floating point processor and a memory management unit, handle complex tasks that would take an inordinate amount of space if incorporated onto the CPU. Motorola has just introduced a memory controller, the MC68451 to assist the 68000 in managing its 16 Mbyte address space. Zilog has already started delivery on its memory management circuit, the Z8010.

Compared to 8-bit designs, the new 16/32-bit CPUs offer a wide range of advantages to system designers, including compatibility with high level languages, faster throughput, larger memory, and addressing space in the Mbyte range.

Programs developed with high level languages are machine independent, which means that the programmer does not have to be familiar with the internal details of the particular CPU. Therefore, programs written on one CPU can be used on another without modifications.

Such software portability has not existed in the microprocessor field so far. The new 16/32-bit CPUs generally have certain features that aid compilation in high level languages, such as hardware multiply, divide and shifts; an expanded complement of addressing modes; multiple stacks and automatic decrement and increment. In addition, memory pointers of 16 bits or more in width allow for more memory accessibility.

The regularity of the instruction sets of most of these new 16 and 32-bit processors also allows for easy implementation of high level languages. Regularity means that a high percentage of the instructions can use the same addressing modes and can operate with any of the data types—either bits, bytes or long words. Also some of the processors have a number of special instructions that speed up certain aspects of code compilation.

8-bit microprocessors are generally limited to an addressing space of 64K bytes. By comparison, the addressing range of the new 16-bit CPUs is enormous, generally 1 Mbyte or more, with the 32-bit CPU in excess of 10 to 20 Mbytes at a minimum. Some can even operate in an extended or segmented mode for additional capability. Sophisticated memory management schemes are available, not only to extend memory range but to provide memory protection, segment variation and relocation.

A concern on the part of many small business and personal computer manufacturers has been how to obtain the higher performance and greater memory accessing capability of the 16-bit designs, but retain software compatibility with their 8-bit CPU based designs.

Obtaining high performance

To meet this need, interim 16-bit hybrid designs have been developed, including the Z800 from Zilog, the 8088 from Intel, the 9980 from Texas Instruments and the 6809 from Motorola.

The Z800, which can run Z80-based software three to five times faster without revision, will be offered in two versions: a multiplexed Z800 bus compatible version that supports 16-bit data transfers and a non-multiplexed configuration compatible with the Z80 bus. The idea is to make it possible for users to upgrade hardware now with the Z800, allowing easy accommodation to the 16-bit Z8000 when software becomes available for that processor.

The Z800 is the first 8-bit machine to support 16-bit hardware, while retaining complete compatibility with previous generation software. The approach taken by Intel with the 8088 and TI with the 9980 is to offer 8-bit versions of their 16-bit processors, so that current equipment can execute 16-bit code while maintaining an 8-bit bus.

The 6809 design is somewhat similar to the Z800, except that the former does not maintain total operation code compatibility with the 6800, nor does it support 16-bit 68000 bus structures. It does, however, offer five times the speed of the 6800, as well as some internal 16-bit data paths for the user.

Until recently, most single chip microcomputer designs, such as the 8048, 8049, 8050, 8051 and 3870 were primarily I/O oriented devices aimed at low end control applications.

But with the development of bus-oriented single chip microcomputers such as the Z8 from Zilog and the

series 70 family from National Semiconductor, a wide range of traditional computing jobs in terminals, personal computers and word processors can now be made extremely portable. Indeed, low cost personal computers capable of "speak" high level languages are possible, via on-chip storage of condensed versions of such languages as Basic and Pascal. But perhaps the most exciting areas lie in multiprocessing applications, where several processors operate simultaneously on different programs, while sharing common memory and peripherals.

Even in traditional personal and small computer applications, multiprocessing is already being employed to increase the throughput and processing capability of present 8-bit designs. Commodore, for example, uses single chip microcomputers as intelligent controllers in the peripherals it supplies with its personal computers to relieve the main CPU from those chores.

Dual processing power

The Z80 Softcard from Microsoft, in addition to giving the Apple II CP/M software compatibility, also turns that personal computer into a powerful dual processor. With the Softcard installed, the Z80 handles all of the traditional data processing and memory accessing jobs, while the Apple II's resident 6502 microprocessor handles all the peripheral accessing chores.

New small computers just now appearing on the market also employ dual processors. Hewlett-Packard's new CP/M-based personal computer uses two Z80 processors, as does Zenith Data Systems' Z89 computer and Fujitsu Ltd.'s Micro 8 computer, which incorporates two 6809s.

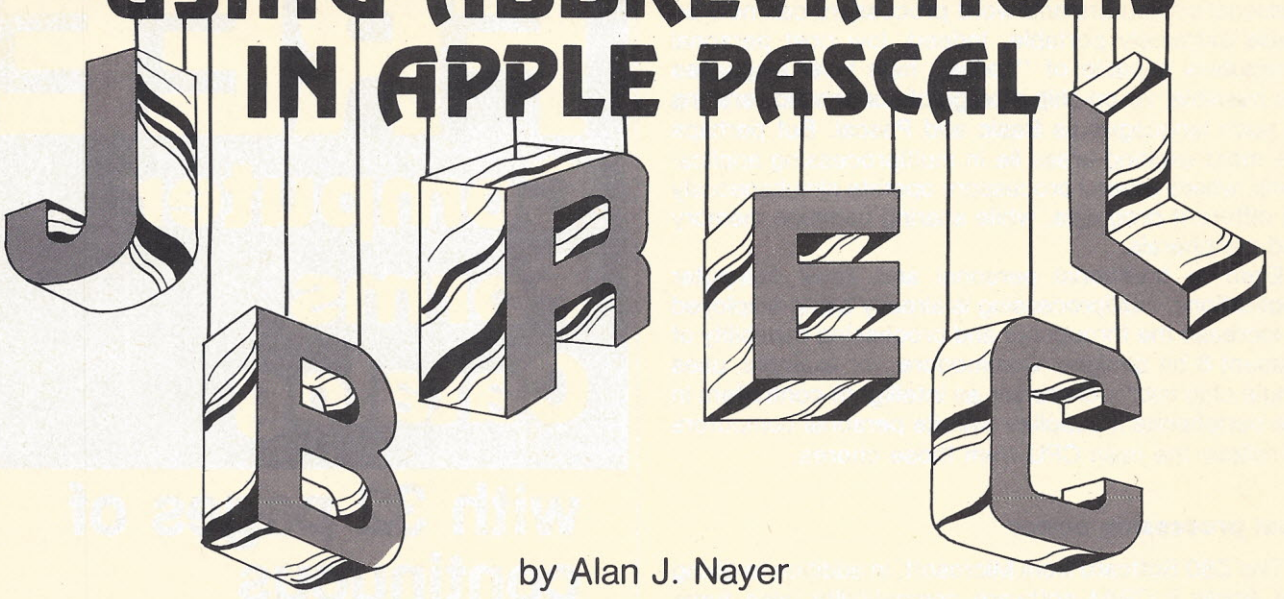
The Z8 and Series 70 are aimed at such applications as these. Fabricated with standard silicon gate NMOS, members of the series 70 family include the INS8070 with 64 bytes of on-chip RAM for data and no program ROM; the INS8072, with 2.5K bytes of ROM and the INS8073, which contains a Basic interpreter stored in the 2.5K bytes of on-chip ROM. In addition to incorporating the control logic needed for handling the bus contention problems associated with multiprocessing, the series 70 devices contain a number of specialized instructions helpful in word and data processing.

Outstanding design

An even more powerful design is the Z8, with an architecture characterized by a flexible I/O scheme, an efficient register and address space and a number of ancillary features helpful in many applications. For I/O applications, the Z8 has 32 pins dedicated to input and output. But because the multiplexed data bus is merged with the I/O oriented ports, the Z80 can assume many different memory and I/O configurations, ranging from a self-contained small computer to a microprocessor that can address 124K of external memory, or a parallel processing element in a system with other processors and peripheral controllers. On the chip also are 2K bytes of mask programmed ROM.

To unburden the program from coping with real time problems such as serial data communication and counting/timing, the Z8 also has an on-chip universal asynchronous receiver/transmitter (UART) and two counter timers with a large number of user selectable modes. □

USING ABBREVIATIONS IN APPLE PASCAL



by Alan J. Nayer

Inherent in most high-level programming languages is a wordiness that is usually considered a good trait. The similarity to English and the use of meaningful datanames lends a readability to the resultant code that aids the programmer in understanding, modifying and debugging a program.

One of the goals of CODASYL (the Conference On Data Systems Languages) was to create a language that was self-documenting. While not many programmers would agree that the language that resulted from this conference, Cobol, is fully self-documenting, not many would disagree that a well-written Cobol or Pascal program is easier to follow than an Assembler program. However, the wordiness can cause time-consuming and tiring sessions at the keyboard when creating a program in these languages.

One step is to allow certain oft-used words or phrases to be represented in an abbreviated form. For example, at one installation, the frequently used Cobol clause VALUE SPACE was abbreviated by the three characters .VS. At another, this abbreviation and all others were entered at the terminal in lowercase (non-abbreviations were entered in uppercase); VALUE SPACE was entered as the two characters vs. In both cases, the source had to be run through a utility program to expand all abbreviations to full form before compilation could proceed.

With Apple Pascal version 1.1, this time- and key-stroke-saving idea can be easily exploited to provide Pascal programmers with a set of useful abbreviations. One of the shortcomings of version 1.0 was the absence of exec files, such as those available in many Basic operating systems, including Apple's DOS, and in many mainframe editors, although not always known by the name exec.

An exec file can be broadly defined as a file of operating system commands. There are often tasks that the programmer must carry out repeatedly with no or few modifications. For example, those proficient in Apple Pascal probably repeat a short series of commands every time they boot the Pascal operating system. I almost always immediately enter the Filer, set the prefix volume to the diskette in drive #5, request an extended directory listing of the prefix volume, and (if it is the first time I've logged on that day) update the system date.

Pascal's new exec feature allows me to store these commands in a text file, then execute this file of operating system commands whenever I boot up, or at any other applicable time. The exec file to perform the above tasks would appear as follows:

```
%FP#5
E:
D%%%%
```

The percent signs are exec delimiters; one is needed to initiate an exec file, four to terminate it. Those seeking more information on exec file syntax, capabilities and idiosyncracies should consult the addendum to the Apple Pascal operating system reference manual.

If I named this file BOOT.TEXT and stored it on the boot volume, I could run it after booting Pascal by entering X for execute, followed by EXEC/boot, then sit back and watch the operating system carry out my commands, just as if I was busily keying them in. After completion of the exec, the screen will be displaying the current system date and the system will be waiting for me to change it if I desire.

The first steps in implementing an abbreviation-expanding exec file are devising the means of abbreviation and choosing the strings to abbreviate. The best format for an abbreviation is one that begins with a special character, henceforth called the abbreviation indicator, such as the exclamation point (!), succeeded by a one- or two-character abbreviation. For example, the word READLN could be abbreviated !RL, the phrase PACKED ARRAY, !PA, etc.

The selection of strings to be abbreviated was based on two factors: the length of the string and its frequency of use. Although it might be nice to supply an abbreviation for the word PROGRAM, it was omitted from my list since it will almost always appear only once in a source program; conversely, the short word END was included due to its high frequency of use. Undoubtedly, other programmers would differ in their selection of strings to abbreviate. See figure 1 for a listing of my

exec file, EXPAND.TEXT. In order to show the leading space in most lines, and also to refer to specific lines in the exec file, each line is prefixed by the line number and an arrow (→). Both of these items do *not* appear in the actual exec file.

Let's follow the execution of the exec file. First, the E after the exec delimiter in line 1 causes the system to enter the Pascal Editor; it is assumed here that the file to act upon is workfile, *SYSTEM.WRK.TEXT. After entering the Editor, the command bJB, where b represents the blank character, causes a jump to the beginning of the file, an unnecessary command at this point that is here for the sake of uniformity and readability of the exec file. The / indicates that the next edit command should act on all occurrences of the source string. RL is the command to replace "literally" occurrences of the source string with the target string. Both the source !BR, and target BLOCKREAD, are delimited by slashes.

Replacing strings

To sum up this action, all occurrences of the string !BR will be replaced by the string BLOCKREAD, even if the string !BR is not a true word, i.e., is not necessarily preceded or succeeded by an alphanumeric (the L provides this option). If the Editor does not find any strings with the value of !BR in the file, it returns the message, PATTERN NOT IN THE FILE, and waits for a space before continuing. Therefore, a leading space is provided in the next line. If one or more occurrences of the source string were found, the space does no harm; it simply moves the cursor one position before jumping to the beginning of the file, when it interprets the JB edit command. After the last replacement has been acted upon, the Editor is instructed to quit by the Q in line 69.

It is next directed to write the edited file to the boot diskette under the name SYSTEM.EXP.TEXT. Upon normal termination, the exec file leaves the edited file in the Editor in the event you want to view or modify it.

Figure 2 shows a short program that will count the number of occurrences of any character in a textfile; abbreviations were used whenever possible. I saved this source program as the workfile and then executed the exec file by entering XEXEC/EXPAND.

In a few minutes, I had an additional file on my boot volume, SYSTEM.EXP.TEXT, the expanded version of the workfile (see figure 3).

Further explanation of some of the abbreviations is warranted. The last five, lines 64 through 68, are unique in one respect; the abbreviations following the abbreviation indicator are just one character in length rather than two, like the others. This is suggested because, depending on one's coding style, these words may often be the last word on a line. Unlike the word PROCEDURE, the word REPEAT is often the last (usually only) word on a line.

Using an abbreviation !Rb (where b again represents a blank) would not affect a replacement of the abbreviation !Rb with REPEATb, unless you remember to place a trailing blank after the abbreviation. Another way to reconcile this problem is to use a normal two-character abbreviation for REPEAT, such as !RP, but since this exec file is intended to reduce the number of keystrokes needed, the former method is better. However, these one-character abbreviations should remain at the end of the exec file. If the replacement of !R is placed

```
 1-->%E
 2--> JB/RL/!BR//BLOCKREAD/
 3--> JB/RL/!BW//BLOCKWRITE/
 4--> JB/RL/!B;//BOOLEAN;/
 5--> JB/RL/!C //CASE /
 6--> JB/RL/!C;//CHAR;/
 7--> JB/RL/!H(//CHR(/
 8--> JB/RL/!C(//CLOSE(/
 9--> JB/RL/!CN//CONCAT/
10--> JB/RL/!CS//CONST/
11--> JB/RL/!CO//COPY/
12--> JB/RL/!D(//DELETE(/
13--> JB/RL/!D //DOWNTO /
14--> JB/RL/!E(//EOF(/
15--> JB/RL/!X(//EXIT(/
16--> JB/RL/!FL//FALSE/
17--> JB/RL/!FI//FILE/
18--> JB/RL/!FR//FORWARD/
19--> JB/RL/!F //FUNCTION /
20--> JB/RL/!G //GOTO /
21--> JB/RL/!Y(//GOTOXY(/
22--> JB/RL/!I(//INSERT(/
23--> JB/RL/!I;//INTEGER;/
24--> JB/RL/!IO//IORESULT/
25--> JB/RL/!KB//KEYBOARD/
26--> JB/RL/!L(//LENGTH/
27--> JB/RL/!O(//ORD(/
28--> JB/RL/!PA//PACKED ARRAY/
29--> JB/RL/!-(//PRED(/
30--> JB/RL/!PR//PRINTER/
31--> JB/RL/!P //PROCEDURE /
32--> JB/RL/!R(//READ(/
33--> JB/RL/!RL//READLN/
34--> JB/RL/!RC//RECORD/
35--> JB/RL/!S(//RESET(/
36--> JB/RL/!RW//REWRITE/
37--> JB/RL/!S;//STRING;/
38--> JB/RL/!+(//SUCC(/
39--> JB/RL/!TR//TRUE/
40--> JB/RL/!TP//TYPE/
41--> JB/RL/!UR//UNITREAD/
42--> JB/RL/!UW//UNITWRITE/
43--> JB/RL/!U //UNTIL /
44--> JB/RL/!V //VAR /
45--> JB/RL/!W //WHILE /
46--> JB/RL/!W(//WRITE(/
47--> JB/RL/!WL//WRITELN/
48--> JB/RL/!KP//KEYPRESS/
49--> JB/RL/!N(//NOTE(/
50--> JB/RL/!RN//RANDOM/
51--> JB/RL/!BL//BLACK/
52--> JB/RL/!CT//CHARTYPE/
53--> JB/RL/!F(//FILLSCREEN(/
54--> JB/RL/!M(//MOVETO(/
55--> JB/RL/!PC//PENCOLOR/
56--> JB/RL/!RV//REVERSE/
57--> JB/RL/!T(//TURNTO(/
58--> JB/RL/!TX//TURTLEX/
59--> JB/RL/!TY//TURTLEY/
60--> JB/RL/!VP//VIEWPORT/
61--> JB/RL/!WC//WCHAR/
62--> JB/RL/!WH//WHITE/
63--> JB/RL/!WS//WSTRING/
64--> JB/R/!B//BEGIN/
65--> JB/R/!E//ELSE/
66--> JB/R/!N//END/
67--> JB/R/!R//REPEAT/
68--> JB/R/!T//THEN/
69--> QW*SYSTEM.EXP
70-->%%%%
```

Figure 1. A listing of EXPAND.TEXT, the Pascal exec file used to expand a set of abbreviations.

before the replacement of, say, !R(, all !R('s in the source program would be replaced by REPEAT(.

I grouped together some of the keywords utilized in two of Apple's intrinsic units, APPLESTUFF (lines 48 through 50) and TURTLEGRAPHICS (lines 51 through 63). If the program you want to expand does not use one or both units, leaving these replace commands in the exec file will not be detrimental.

However, to speed up the exec file, especially if your source program is large, the following tactic can be used. Suppose the program uses neither APPLESTUFF nor TURTLEGRAPHICS units, modify the exec file by inserting a < just before the JB in line 48. Then insert a > just before the JB in line 64. This will reverse the cursor direction for the duration of these commands and the exec file will rapidly pass through these replacements without scanning the whole file.

One final option is the choice of the abbreviation indicator. The letters of the alphabet and numbers can, of course, be discarded, leaving the special characters. I have used the ! in my demonstration, since it is highly unlikely that it will be immediately followed by a nonblank (if it is used at all) in most Pascal programs. The characters !"#$%&?@ are probably the best candidates, since they are not meaningful Pascal symbols and are enterable from the standard Apple keyboard. Under most circumstances, I take a risk and use the period, since it does not require hitting the shift key. The period should be considered only if you do not work very often with RECORD definitions, because record qualification syntax usually requires a period.

While most Basic operating systems store all commands as a one-byte token, Pascal sources are not compressed, except for crunching leading spaces. Therefore, the amount of disk space used to store programs faithfully depends on how many characters are in the source. (Apple Pascal rounds the number of blocks up to the nearest even number.)

I noticed that the abbreviated program in figure 2 used up four 512-byte blocks, while the expanded version reserved six blocks. Therefore, it may prove beneficial to create a second exec file, possibly called COMPRESS.TEXT, which is basically a reversal of EXPAND.TEXT. The replacements should produce a compressed version of a source program by replacing all occurrences of BLOCKREAD WITH !BR, etc.

I tried this on a 30-block Pascal program and ended up with a 26-block abbreviated version, thereby saving 2K of disk space. Of course, this is useful only for relatively stable files, since the source program would have to be run through EXPAND.TEXT before compilation. A good use would be for increasing the number of programs that can be stored on your backup diskettes.

For those of you who use the Pascal Editor as a simple word processor for creating documents, a similar abbreviation-expanding exec file may be used to expand abbreviations of the words or phrases most often used in everyday documents. For example, writing business letters might be simplified by creating abbreviations for your name, address, city, telephone number and other commonly used items. Note that the possibility of confusing the exec file increases when working with upper and lowercase; the U option of the replace command may be useful in relieving this. □

Figures 2 and 3 follow

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```
                                                    (*$Q+,L!PR:*)
PROGRAM COUNT!C;
!V CH,SEARCHCH:!C;
    CTR:!I;
    IN!FI:TEXT;

!P GET!FI;
!V !FINAME:!S;
    FOUND!FI:!B;

!B
  !R
    !W('INPUT TEXT !FI? ');
    !RL(!FINAME);
    IF POS('.TEXT',!FINAME)=0
      !T !FINAME:=!CN(!FINAME,'.TEXT');
                                                    (*$I-*)
    !S(IN!FI,!FINAME);
                                                    (*$I+*)
    FOUND!FI:=!IO=0;
    IF NOT FOUND!FI !T !WL('NOT PRESENT',!H(7))
  !U FOUND!FI
!N;



!P GET!C;

!V OK:!B;

!B
  !R
    !W('COUNT OCCURRENCES OF WHICH CHARACTER? ');
    !R(SEARCHCH);
    !WL;
    !WL(SEARCHCH,'<-- IS THAT CORRECT? ');
    !R(CH);
    OK:=CH IN ['Y','y'];
    !WL
  !U OK
!N;



!P COUNT;

!B
  CTR:=0;
  !W NOT !E(IN!FI) DO
  !B
    !W NOT EOLN(IN!FI) DO
    !B
                                                    (*$I-*)
      !R(IN!FI,CH);
                                                    (*$I+*)
      IF !IO<>0 !T
      !B
        !WL('I/O ERROR !W READING');
        !X(COUNTCHAR)
      !N;
      IF CH=SEARCHCH !T CTR:=!+(CTR)
    !N;
    !RL(IN!FI)
  !N
!N;


!B
  GET!FI;
  GET!C;
  COUNT;
  !C(IN!FI);
  !WL('THERE ARE ',CTR,SEARCHCH:2,'''S IN THIS !FI')
!N.
```

Figure 2. A short Pascal program entered in abbreviated format

```
                                        (*$Q+,LPRINTER:*)
PROGRAM COUNTCHAR;

VAR CH,SEARCHCH:CHAR;
    CTR:INTEGER;
    INFILE:TEXT;


PROCEDURE GETFILE;

VAR FILENAME:STRING;
    FOUNDFILE:BOOLEAN;

BEGIN
  REPEAT
    WRITE('INPUT TEXT FILE? ');
    READLN(FILENAME);
    IF POS('.TEXT',FILENAME)=0
      THEN FILENAME:=CONCAT(FILENAME,'.TEXT');
                                        (*$I-*)
    RESET(INFILE,FILENAME);
                                        (*$I+*)
    FOUNDFILE:=IORESULT=0;
    IF NOT FOUNDFILE THEN WRITELN('NOT PRESENT',CHR(7))
  UNTIL FOUNDFILE
END;



PROCEDURE GETCHAR;

VAR OK:BOOLEAN;

BEGIN
  REPEAT
    WRITE('COUNT OCCURRENCES OF WHICH CHARACTER? ');
    READ(SEARCHCH);
    WRITELN;
    WRITELN(SEARCHCH,'<-- IS THAT CORRECT? ');
    READ(CH);
    OK:=CH IN ['Y','y'];
    WRITELN
  UNTIL OK
END;



PROCEDURE COUNT;

BEGIN
  CTR:=0;
  WHILE NOT EOF(INFILE) DO
  BEGIN
    WHILE NOT EOLN(INFILE) DO
    BEGIN
                                        (*$I-*)
      READ(INFILE,CH);
                                        (*$I+*)
      IF IORESULT<>0 THEN
      BEGIN
        WRITELN('I/O ERROR WHILE READING');
        EXIT(COUNTCHAR)
      END;
      IF CH=SEARCHCH THEN CTR:=SUCC(CTR)
    END;
    READLN(INFILE)
  END
END;


BEGIN
  GETFILE;
  GETCHAR;
  COUNT;
  CLOSE(INFILE);
  WRITELN('THERE ARE ',CTR,SEARCHCH:2,'''S IN THIS FILE')
END.
```

Figure 3. The program in figure 2, after it passed through the abbreviation-expanding exec file, EXPAND.TEXT

A Master Disk Directory

by Gene Cotton

When working with disk files under CP/M, a particular file may be known to exist, but exactly which diskette contains the file is a mystery. In order to find the disk file, each diskette is inserted, the directory is listed, the diskette is removed and the new diskette is selected. This process continues until the disk file is found. This program was developed after a time-consuming search, while learning a new programming language called C. The objective was to create and maintain a master file that would contain the file names and locations of all files on all diskettes.

General requirements of a master directory are that the program: runs as a stand-alone program under CP/M; utilizes the existing CP/M directories; provides for "Adds," "Changes," and "Deletes," to the master directory by volume identification; lists the entries in the master directory based on search arguments with wild card options; and provides for extracting data from the master directory by search arguments into an ASCII .DAT file.

The C compilers usually generate .ASM files, which are assembled and loaded into a resultant .COM file. This satisfies the requirement for a stand-alone program. By utilizing CP/M BDOS function calls, the portability of the program is insured.

The directory of CP/M is organized as 4 entries of 32 bytes each per sector (128 bytes). The number of sectors is dependent upon the particular CP/M installation. Typically, 8 or 16 sectors are assigned, depending upon the diskette density.

A particular entry is "active" if the first byte is not equal to hex E5. Most IBM compatible diskettes are initialized by writing hex E5 into each sector during the formatting process. An active entry contains the filename and extension in the 2nd through the 12th bytes. Bytes 17 through 32 contain the addresses of the disk allocation blocks used for the file. The number of sectors actually used within the blocks is specified by byte 16 of the directory entry. The allocation is a function of the density, with single density usually 8 sectors per block. With 1K (1024 bytes) allocation blocks, only 16K can be allocated in each directory entry. Files larger than 16K would require additional directory entries. Each entry for a file is called an extent, and this information is kept in byte 13 of the directory entry.

The amount of disk space used by the file is calculated by adding the disk space allocated in each extent for the file. The amount of space used by a file and the amount of space allocated for a file will be slightly different. In order to accurately determine the amount of unused space on a diskette, it is better to use the allocated space.

It is useful to begin the investigation with the CP/M BDOS function calls that will be used. Function 0 (System Reset) is used to abort the program in the event that function 12 (Return Version Number) indicates that an earlier version than 2.0 is being used. Function 31 (Get Address of Disk Parameters), which did not exist in CP/M 1.4, is used to calculate the space available on the diskettes. Early experiments with function 35 (Compute File Size) determined that it is much slower than directly calculating the file size using the information returned by functions 17 and 18 (Search For First Directory Entry and Search For Next Directory Entry), and so it is *not* used. Function 14 is used to select the drive of the directory to be listed. Function 25 is used to keep track of the default drive in effect when the program was started.

Before the Master Directory program is written, the format of the Master Directory file must be established. The format used is:

relative
record

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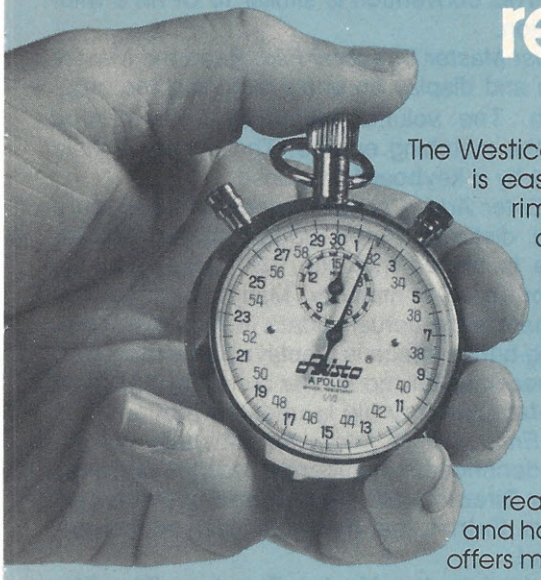

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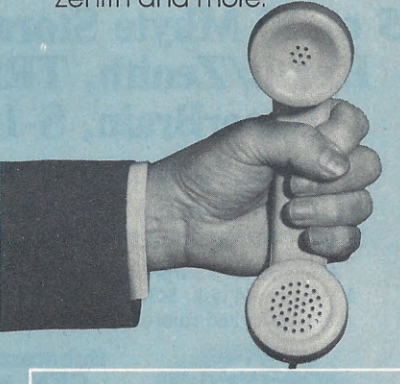

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position	field name
0 - 2	volume identification number
3 - 10	filename
11 - 13	extension
14 - 15	number of kilobytes allocated

The volume number, filename, extension fields can be any of the ASCII characters permitted by CP/M. The number of kilobytes allocated is a binary integer in byte-reversed format. With this record format, the file can be blocked at 8 records per sector. This will simplify the file handling routines. The binary numbers in the file sometimes cause a text end-of-file character. File transfers using the PIP function of CP/M must use the "[0]" option to correct this problem.

To provide a textual (ED.COM readable) file, the extract function of the program will use a record format of:

relative record position	field name
0 - 2	volume identification number
3 - 10	filename
11 - 13	extension
14 - 16	number of kilobytes allocated
17	carriage return
18	line feed

The format differs with the addition of the carriage-return, line-feed fields, and the number of K-bytes allocated is output as decimal digits with one extra character position added.

The functions that are performed are common to all maintenance or update programs: add, change, delete.

The abilities to stockpile transactions (adds, changes, and deletes), list the master file and list the pending actions have been added to facilitate human interface.

The program will display a menu and return to it after each function. Options 1 and 8 allow for wild-card characters within the volid, filename and extension specifications. Normally, if a volid, filename, and/or extension is specified, only those entries that exactly match are processed. If a field is not specified, it is assumed that any field found is a match. If a question mark (?) is used within a field, it is assumed that any character found is a match. The asterisk (*) is used when the remaining characters in the field can match any pattern. This convention is similar to CP/M's wild-card convention.

Option1, List Master Directory File. Read the Master Directory file and display an entry matching the argument pattern. The volume identification is printed followed by the matching entries. The display is held until released by a keyboard response.

Option 2, Enter Add (Change) (room for 2065 more entries). The diskette to be added to the Master Directory file is placed into the "B" drive, and the directory is buffered in memory. Many diskettes may be buffered before the actual update (option 4) occurs. The remaining buffer space is displayed as a reminder. If the buffer becomes full, no further buffering is allowed until the Master Directory file is updated (option 4).

Option 3, Enter Delete (room for 32 more volids). The volume identification numbers of entries currently on the Master Directory file are buffered until the next update occurs. Entries that have just been added may not be deleted.

Option 4, Update the Master Directory File. The Master Directory file is read. Any incoming volume that matches a delete request is discarded. Any incoming volume that matches an add (change) request is dropped in favor of the new volume information. The unaffected records from the old master file and the add (change) volume information are merged to form a new master file with a .$$$ extension. The old master file is renamed to .BAK and the .$$$ file is renamed to .DIR. All pending transactions (adds, changes, and deletes) are erased.

Option 5, Display Deletes List. An ordered list of volume identification numbers of requested deletes is provided.

Option 6, Display Adds (Changes) List. An ordered list of volume identification numbers of requested adds and/or changes is provided.

Option 7, Display Adds (Changes) Entries. The memory buffer is displayed to reveal each directory to be added to or changed on the Master Directory file. The display can be aborted after any volume by pressing the control-C key in response to the "...press any key to continue" message.

Option 8, Extract from Master Directory File. Any volid, filename, extension on the Master Directory file that matches the request pattern is copied onto a new file named [MASTER].DAT, with automatic conversion of the binary integer value for allocated disk space to decimal digits.

Option 9, Exit to CP/M. Immediately terminates the program and returns to CP/M by way of the warm-boot. □

Program on page 162

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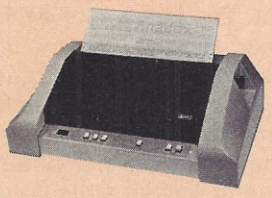

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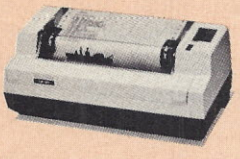

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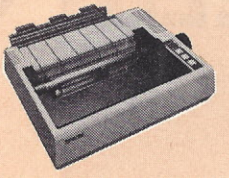

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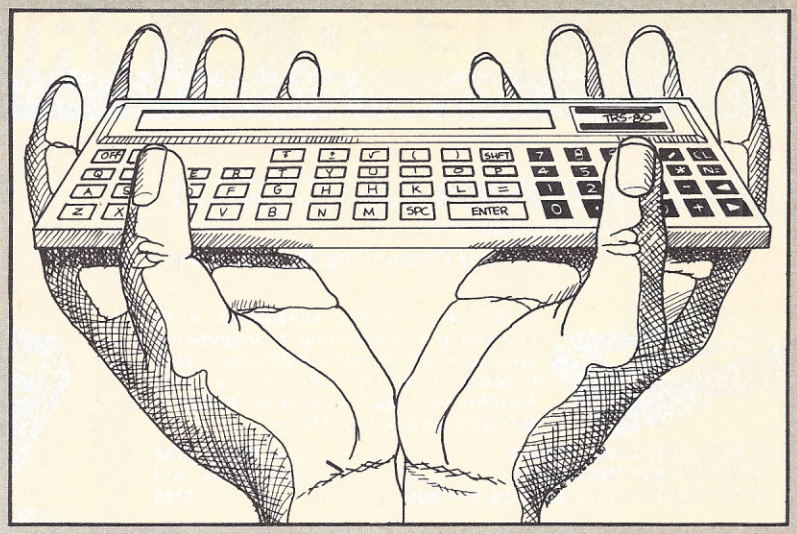
A PRINTER FOR THE HANDHELD TRS-80

by Alan R. Miller



The Radio Shack handheld computer is truly pocket size. It measures less than 3 by 7 inches and has a one-line, 24-character liquid crystal display (LCD). The alphabetic keys are arranged in the usual typewriter style with a 10-key numeric pad on the right. The 12K bytes of memory include a 7K Basic interpreter and a 4K monitor. The remaining memory is for user programs.

Over 1,400 programming steps can be entered by the user. Editing is fast and efficient; any line can be recalled from memory and altered. When the left or right cursor movement keys are held down, the cursor rapidly skips across the display line. In a similar way, the forward and reverse scroll keys can be held down to rapidly move through the source programs line by line.

If a syntax error occurs during execution, the program stops and an error message is displayed. The key that scrolls to the previous line can be momentarily held down. This will display the offending line, with the cursor positioned at the location of the problem. When the computer is switched to editing mode, the cursor will still be at this location.

Many different programs can be stored in memory at the same time. Each separate program or subroutine is referenced by an ASCII label placed at the beginning of the section. For example:

```
650 "SIM" REM SIMULATION PROGRAM
660 GOSUB "BIG"
    . . .
700 GOSUB "DET"
    . . .
780 GOTO "SIM"
```

It can take more than an hour to enter a complete set of Basic programs into the pocket computer. Of course, once they are entered, they remain in memory even though the display is switched off. Occasionally, however, the pocket computer refuses to respond and must be reset. Unfortunately, this erases the user programs.

The source programs can be saved on cassette tape if an interface is available. It takes about five minutes to save all programs with the command CSAVE "filename". The computer automatically turns on the tape machine at the beginning, then turns it off at the end. The tape can be verified by rewinding it and playing it back into the computer. Be sure to enter the date and a short note about the nature of the programs as the first few lines of code. When the tape is loaded back at some later date, you will know what the programs are for.

An extremely long program can be segmented into blocks and sequentially chained into memory with the help of the tape recorder. Each block of Basic can be recorded as a separate segment. The last line of each block contains the chain command and the filename of the next segment. The computer will automatically turn on the tape machine, read in the next segment and execute it. With this arrangement, program size is limited only by the length of the tape. The computer can also turn on the tape machine to read or write data generated by the program.

Until recently, the cassette interface has been the only available peripheral. Now there is a combination unit containing both a printer and a cassette modem. The printer turns the pocket computer into a complete micro. When the computer runs without the printer, it stops at each PRINT statement and displays the information. During execution, the user must press the ENTER key once for each PRINT line. However, when the printer is attached, each line is automatically printed in sequence. For example, the program:

```
10 FOR Z = 1 TO 4: X = 1/Z
20 PRINT USING "##"; Z; USING "###.#####"; X
30 NEXT Z
40 STOP
```

will produce the output:

```
1   1.00000
2   0.50000
3   0.33333
4   0.25000
```

A printout of the entire set of source programs can be obtained by giving the LIST command when the computer is in the programming mode. However, if only a single line of Basic code is examined with the command LIST 30, the line is displayed on the computer LCD rather than on the printer. Also, all output from the PAUSE command appears on the LCD rather than at the printer. Consequently, it may be necessary to revise programs after acquiring the printer. Finally, the results from all direct commands such as 16*38 and 1/7 are given on the LCD display.

The printer output is narrow; no more than 16 characters can appear on a line. The impact printer uses a typewriter ribbon and cash register-style tape. The characters are formed with a 5-by-7 dot matrix, although only one row of dots is printed at a time. The

printing speed is 16 characters (one line) per second. The computer by itself is portable, since it is powered by four wristwatch batteries. The printer is separately powered by a rechargeable Ni-Cad battery. According to Radio Shack, this battery can produce 8,000 lines of output on a single charge. The printer can also operate while the charger is connected.

While there are advanced features such as PRINT USING, the computer's Basic dialect is primitive in many respects. Variable names are restricted to the single characters A-Z or A$-Z$. Each string variable can hold up to 5 characters. However, no string operations, such as conversion between string and numeric, are provided. Only a single, one-dimensional array is available. The array elements A(1) through (A26) use the same locations as the variables A-Z (and A$-Z$). Consequently, arrays must be used with care. For short arrays, use the variables X, Y, and Z for loop indices. For example:

```
FOR Z = 1 TO Y
A(Z) = . . .
NEXT Z
```

If more than 20 array elements are needed, start the subscript at 27. That is, use an offset of 26. The Basic program shown in the listing demonstrates this technique. The program can be used to sort a list of numbers entered from the keyboard.

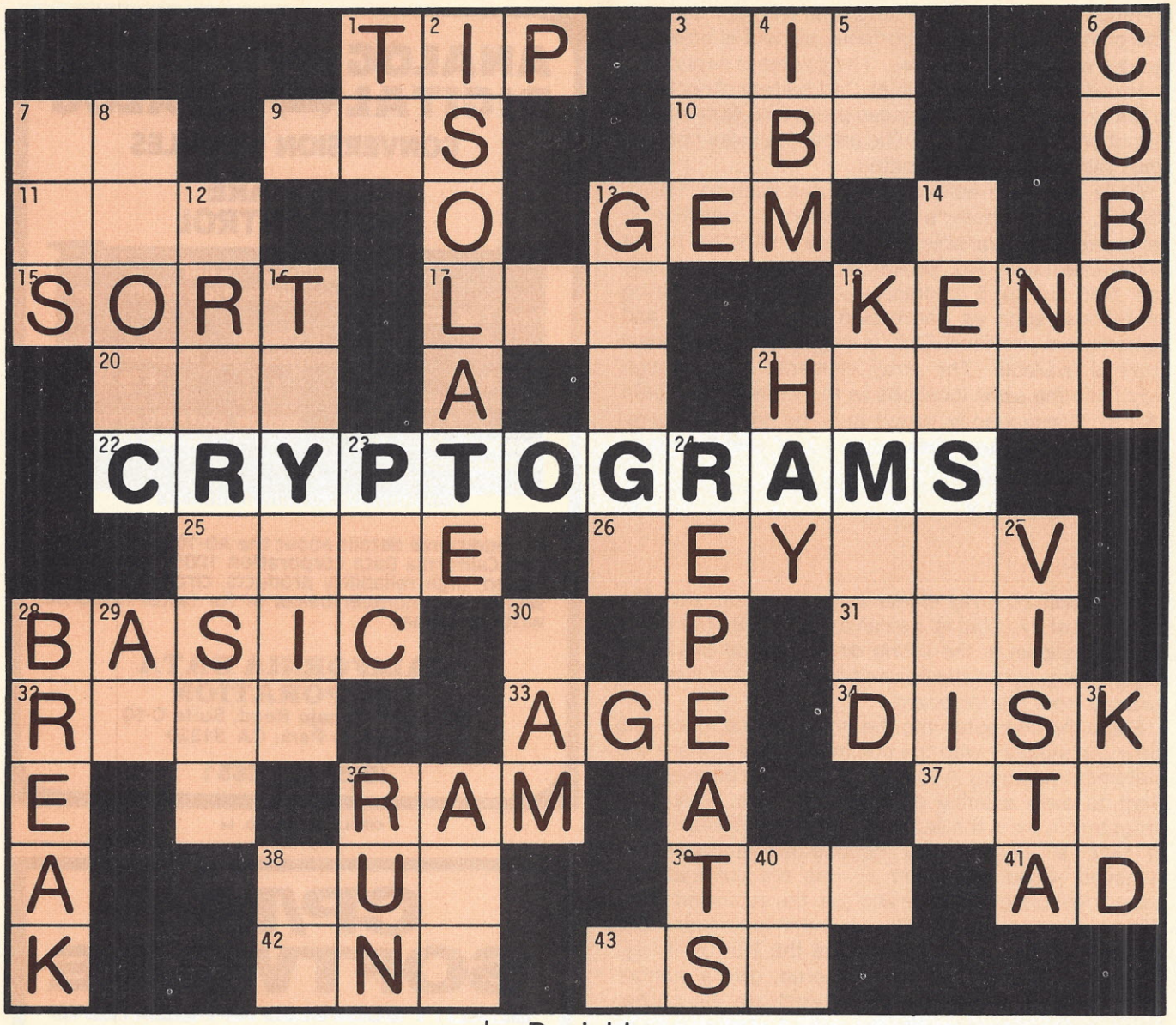
Place the computer into the programming mode and clear the memory with the command NEW if there are statement numbers in the range shown. You may first want to save existing programs on tape. Enter the program shown in the listing. Spaces are not important. In fact, all unnecessary spaces are automatically removed, while necessary spaces are automatically added. Switch to run mode and give the command RUN. Whenever a colon is displayed, enter a number more positive than minus 21 and press the RETURN key. After the last item has been entered, give a number more negative than minus 20 to terminate this phase. The numbers are stored in the array A starting with an index of 27. The items are printed out in their original order; then the sorting subroutine starting at line 300 is called. This Shell-Metzner algorithm is one of the fastest sorting routines. It uses temporary variables B, C, H, I, J, K and M. The variable N contains the number of items to be sorted. The offset for the array index is given by the variable D. After the numbers have been sorted in increasing order, they are printed out again but in the sorted arrangement.

If you want to use this program to sort the numbers in decreasing order, change the less-than symbol in line 310 to a greater-than symbol. To run this program without a printer, change the command PRINT to PAUSE in line 210.

At a price of less than $250, the TRS-80 pocket computer is a bargain. I always take mine with me wherever I go. The printer interface, which includes the tape cassette modem, is priced at $150. The Ni-Cad battery and charger are included.

Two unusual screws, with springs eminating from one end, are supplied with the printer. The owner is instructed to insert them into the back of the computer in place of the original ones. Perhaps this will solve the annoying lockup problem. □

Program on page 168



by Daniel Lovy

For centuries, codes and ciphers have been used for either of two purposes: to keep secret messages secret, or to amuse the puzzle solving sect of society. A cryptogram is a code where the alphabet of the original message is still used, but each letter is altered until the message is no longer readable (see figure 1). Following

```
THIS IS A CRYPTOGRAM

VYQS QS C PFKMVZJFCB
```

Figure 1. Scrambled message

is a cryptogram generator written in level II Basic on a 16K TRS-80 that will also run on a 4K machine.

The types of cryptograms vary in complexity. Some require the receiver to know some key word or phrase on which the code was based to be able to translate it. A rudimentary type of cryptogram is one wherein each letter simply stands for another. For short messages (as in figure 1), this works out fine. However, for something larger, like a letter, the method looses its value as an effective code, but gains appreciably as a puzzle.

```
ZTFR RTFZTR,
     VCQHRFZAYFWKCQI ECR ZTVCZKQH WJKI
MTIIFHT.  IKQVT SCA MAIW JFDT IXTQW F
HRTFW ZTFY CE WKMT KQ ZCKQH IC, K ETTY
K IJCAYZ YTFDT SCA BKWJ ICMT BCRZI CE
BKIZCM.  AQECRWAQFWTYS FYY MS BKIZCM
VCMTI ERCM F HRTFW JAQHFRKFQ IFHT FQZ
MS XRKQWTR BKYY QCW XRKQW JAQHFRKFQ
VJFRFVWTRI, ICRRS.

          VRSXWKVFYYS SCARI,
          WJT MFZ JAQHFRKFQ
```

Figure 2. Sample run

As the message gets longer, more letters and words are repeated. Thus it becomes possible to slowly break the code.

For example, studies of the English language have shown that certain letters of the alphabet occur more frequently than others in a large sampling of "clear" text. The following list from *Collier's Encyclopedia*, 1976 edition, culled from a 50,000-word sample, is typical:

A	7.4%	N	7.9%
B	1.0%	O	7.5%
C	3.1%	P	2.7%
D	4.2%	Q	0.3%
E	13.0%	R	7.6%
F	2.8%	S	6.1%
G	1.6%	T	9.2%
H	3.4%	U	2.6%
I	7.4%	V	1.5%
J	0.2%	W	1.6%
K	0.3%	X	0.5%
L	3.6%	Y	1.9%
M	2.5%	Z	0.1%

If a letter in the encoded text occurs more frequently than any other, it's a good bet that it stands for "e." More sophisticated methods relay the fact that certain letter pairings ("en", "ne", "ing", etc.) regularly crop up in English usage. Of course, the method can be expanded to include whole words, such as "the" and "and."

Encoding the message

Suppose a certain three letter combination appears several times throughout the message. By assuming it to be a "the" or an "and" or some other common three letter word and by replacing those letters with their actual counterparts wherever they appear in the text, some of the code can be broken. When more small words are solved, the letters used can help crack the larger ones.

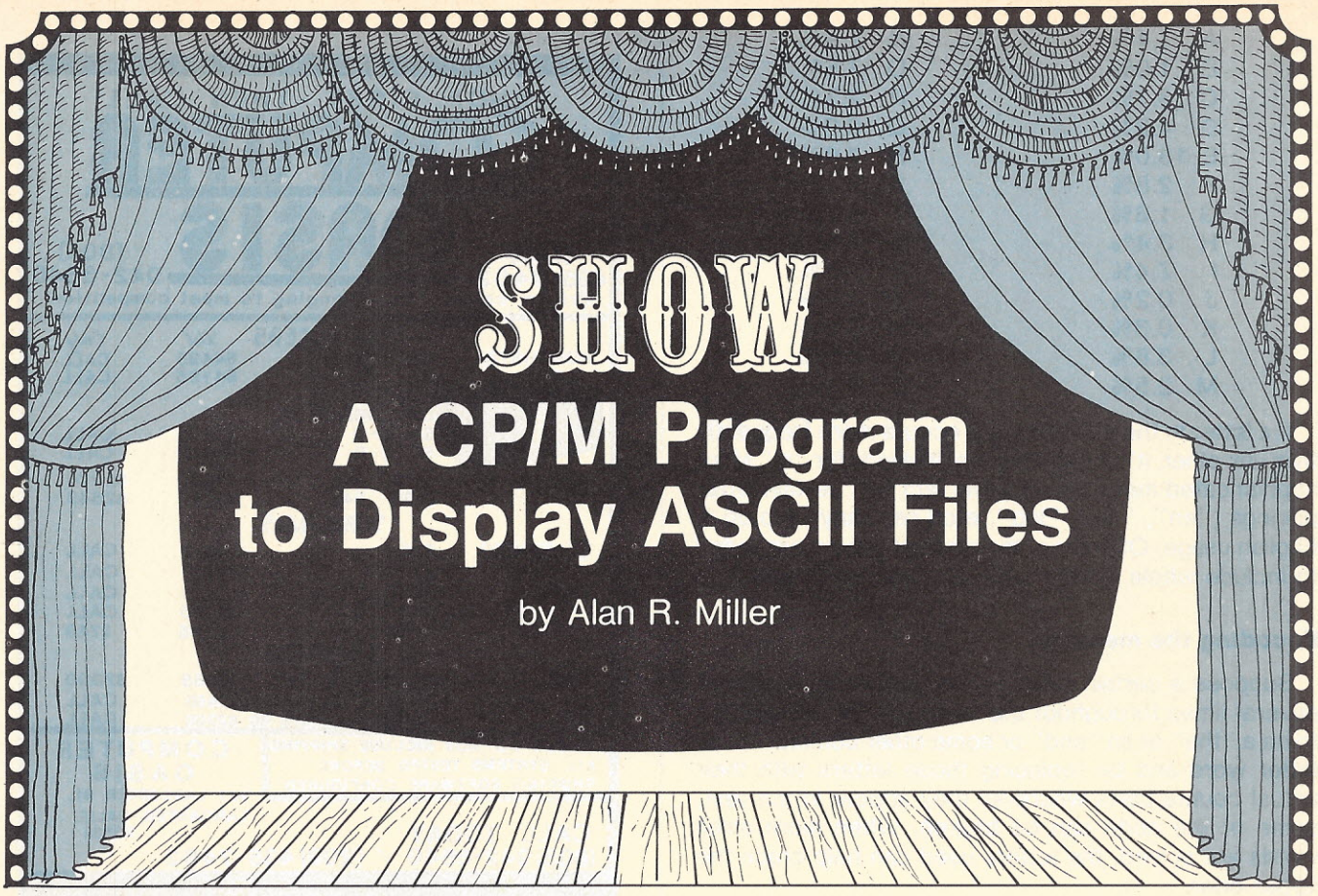
Once you have entered the program and typed in RUN, the program will begin to input your message. It will number each line and provide a winking cursor as an added touch. When the message is finished, enter the last line typed, then an asterisk. The entire text will be printed on the screen and you will be given a chance to correct any lines that appear amiss. After all the corrections have been made, the program will take each letter of your message and replace it with the proper letter from its randomly generated scrambled alphabet, then send the encoded message to a printer.

The printer used in writing the program was Radio Shack's Quick printer. It offers three print densities, 80, 40, and 20 characters per line. I chose the 40 character/line setting to make the output easier to read. The LPRINT CHR$(30) in line 120 does this. If you are using another printer, this statement may not be needed. The test for 40 in the last line of the program limits each line of the text to 40 characters. Again, if you are using a different printer, you can change this to any length of line.

The scrambled alphabet is generated in lines 40 and 50. Line 40 fills array A with the ASCII values of the alphabet (upper case only) and line 50 then scrambles that array. It does this by stepping through each element and switching it with a random element of the array. This provides a quick and suprisingly thorough scramble.

Another interesting feature is the winking cursor. This is done by the subroutine beginning at line 1000. The reason a separate input routine was needed is because the Basic input statement does not allow leading blanks, commas or other types of punctuation to be input in a string variable. If you want your display to have a winking graphics block, change the CHR$(95) in line 1020 to CHR$(143). □

Program on page 168



SHOW
A CP/M Program to Display ASCII Files

by Alan R. Miller

ASCII disk files can be displayed on the console by giving the CP/M command

TYPE (filename)

There are, however, several disadvantages to the use of this command. First, the file scrolls by on the screen so quickly that one must immediately press control-S to freeze the display. The scrolling is then resumed by pressing any key. But control-S must then be pressed again to freeze the next screen. If any key other than control-S is pressed during the scrolling step, the task is aborted.

A second problem occurs when MicroPro's WordStar text formatter is being used at the no-file level. In this case, the disk directory is normally displayed on the console. Any program that can be executed from the system level can genera ly be run by WordStar at this time. Sometimes, it is necessary to inspect an ASCII file at the no-file level prior to an editing step. But the CP/M TYPE command cannot be given at the WordStar no-file level, since it is a built-in command rather than an executable program.

The solution to both problems is to utilize the program given in the accompanying listing. This very short program can be used to display any ASCII file on the console. For example, to inspect a file named LETTER.TXT, give the system command

SHOW LETTER.TXT

Either name can be preceded by the disk name. For example, if the default drive is C and Show is on drive A and LETTER.TXT is on drive B, the command should be

A:SHOW B:LETTER.TXT

The usual CP/M commands are available for error correction when the command line is typed. For example, an incorrect character can be deleted by pressing the DEL or RUB key. A control-R can be given to reprint the input line. If you are using version 2 of CP/M, input errors can also be corrected with the ASCII backspace. A control-U can be given to cancel the entire input line. Of course, a control-C can be typed to abort the program.

Since Show is an executable disk file, it can be run from the no-file level of WordStar by first giving the R command. When the program is run, it fills the console screen with the first 22 lines of the file. Execution then automatically stops and the message: 'Press space bar to continue or anything else to quit' is printed. The next 22 lines of the file can be inspected by pressing the space bar. In this way, the entire file can be viewed, screen by screen. The process can be terminated prematurely by pressing any key other than the space bar.

If the requested disk file does not exist, an error message is printed and the program is terminated. Also, if an attempt is made to display an executable COM file, the program gives an appropriate error message and terminates.

All input and output are handled through calls to the CP/M BDOS at address 5. Thus the program will work with all standard versions of CP/M. The requested filename is read from the file-control block (FCB) at address 5C hex. The original stack pointer is saved at the beginning of the program, and then restored at the end. Thus a warm start is not performed at the conclusion of the program.

If your console screen has less than 24 lines, you will want to change the value of LMAX near the beginning of the program. It should have a value that is two less than the number of lines on the screen. □

Program on page 170

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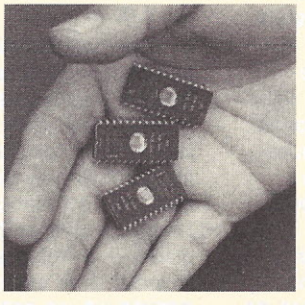

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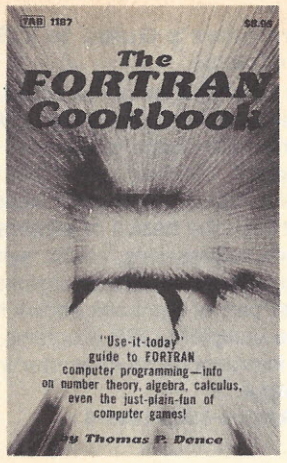

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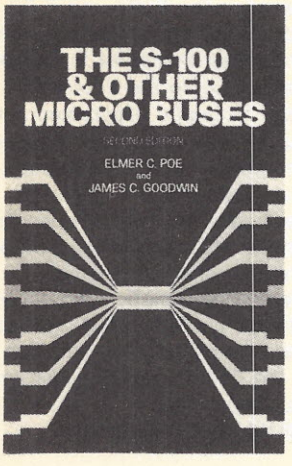

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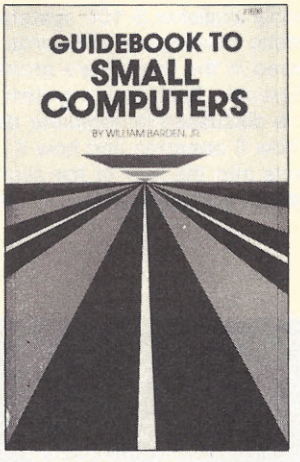

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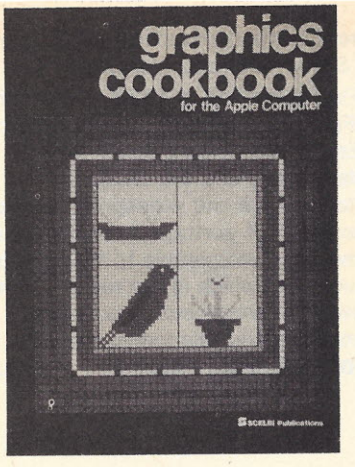

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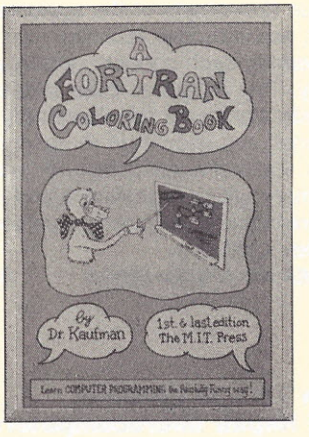

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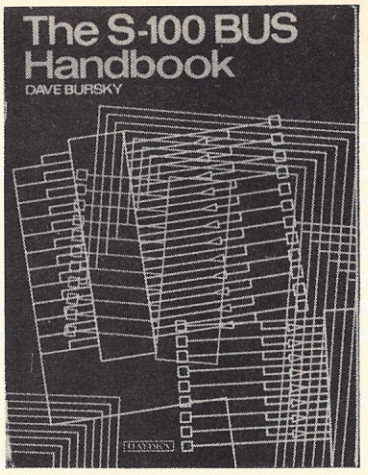

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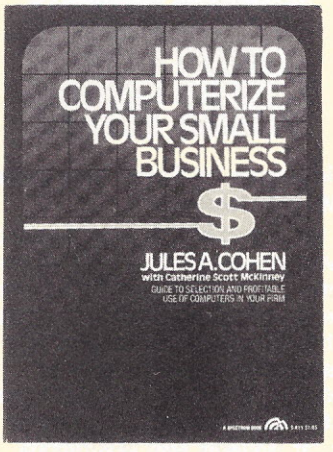

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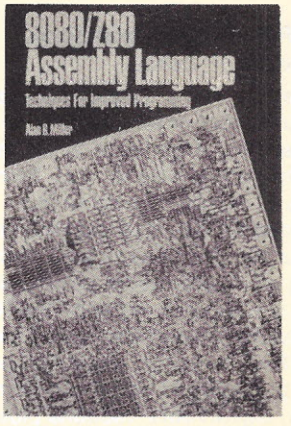

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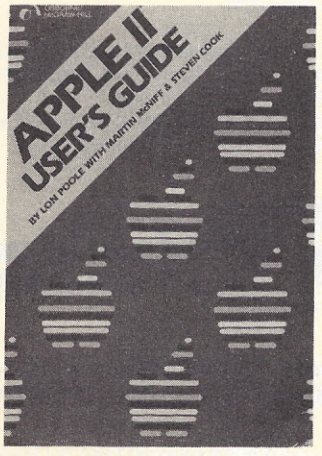

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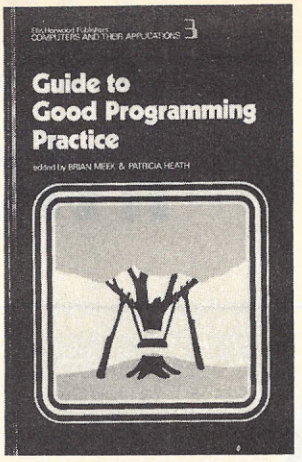

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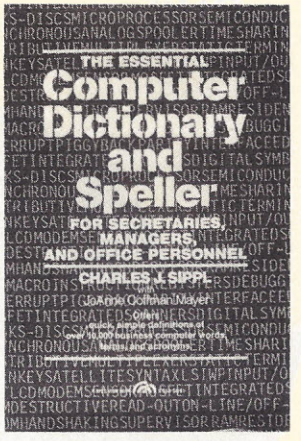

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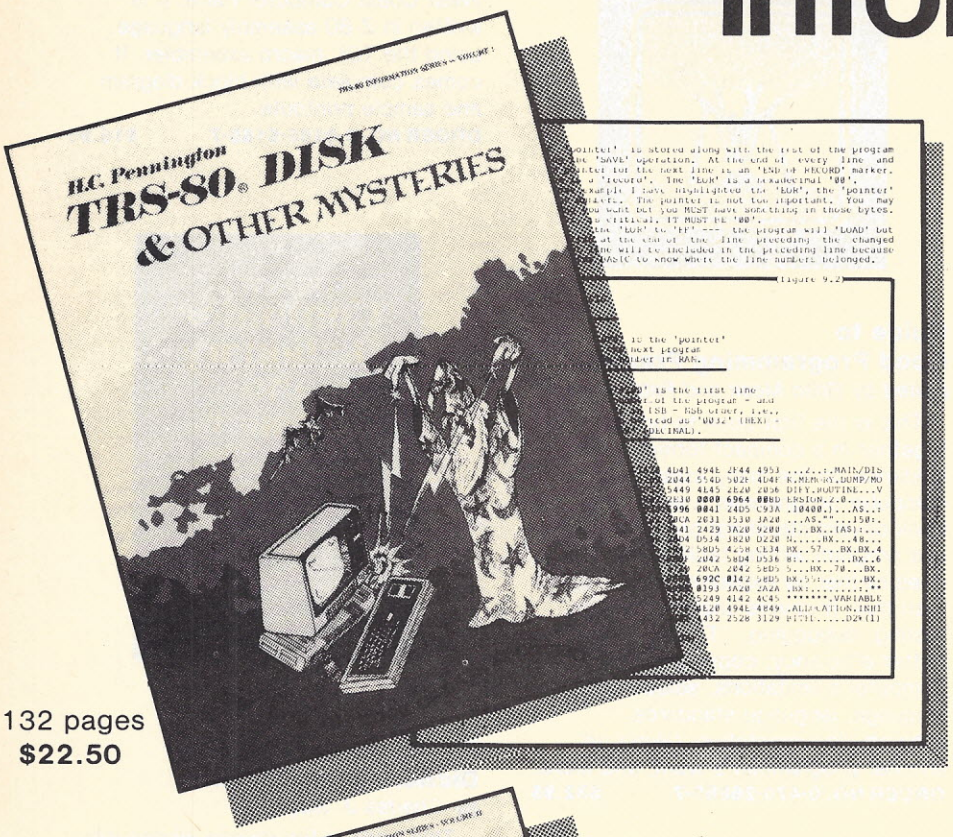

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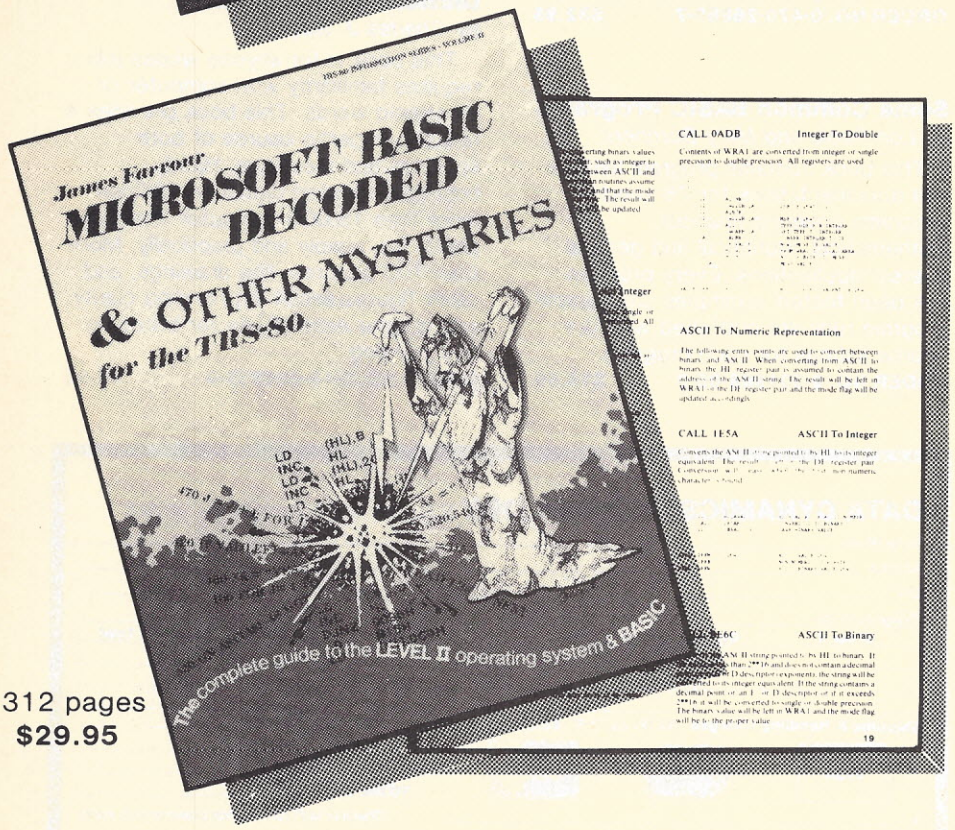

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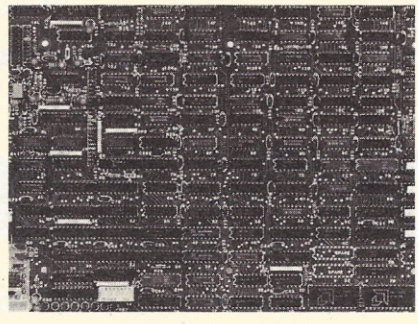

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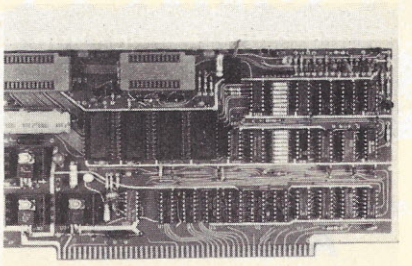
configured not only to 20 simultaneous users, but also for up to 35 different microprocessors. Price: $60,000 range, depending upon memory, terminals, size of disks and software. Boston Systems Office, 469 Moody St., Waltham, MA 02154, (617) 894-7800.
CIRCLE INQUIRY NO. 224

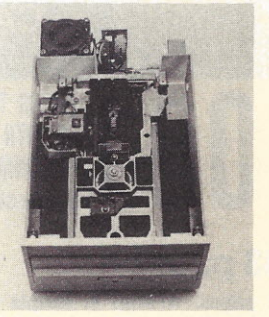
Floppy disk controller board, FDC-880H, is compatible with the Heath 88/89 microcomputer. It allows users to double their 5¼-in. disk storage capacity without adding drives or disks. The board runs under the industry standard CP/M 2.2 operating system and is capable of handling up to four Shugart compatible 5¼-in. or 8-in. drives simultaneously. It also handles single and double-sided operation; single and double-density data. The board converts the 5¼-in. hard sectored disks to standard soft sector double density. It occupies any I/O slot in the H88/H89 microcomputer without modification. Included with the controller board is a 10-ft. interconnect cable, zero origin conversion PROM, boot PROM with floppy diagnostics and hardware/software manuals. Price: $695. CDR Systems, Inc., 7667 Vickers St., Suite C, San Diego, CA 92111, (714) 275-1272.
CIRCLE INQUIRY NO. 225

Dual-service board, PB1, combines programming and memory capabilities and permits improved utilization of slot space in S-100 based microcomputers. Four on-card sockets are provided for a total of either 4096 or 8192 bytes of memory, depending upon whether 2708 or 2716 EPROMs are used. Two programming sockets are also provided, one for a 2708, another for a 2716 —both are DIP-switch programmable to any 4K boundary. The use of Textool sockets,



for example, means that flipping a lever lifts an EPROM out of a programming socket, thus preventing damage (through prying) to both the EPROM and the board itself; separate on-card circuits allow programming of 2708 and 2716 (5 V) EPROMs without board modifications; and the programming voltage is generated on-board. Price for board that's assembled and tested plus complete software: $265. Kit version: $179. SSM Microcomputer Products Inc., 2190 Paragon Dr., San Jose, CA 95131, (408) 946-7400.
CIRCLE INQUIRY NO. 226

Flexible disk drive, model M2894, features a unique dual gimbal head assembly. The double-sided, double-density 8-in. disk drive is fully compatible and interchangeable with industry standards like Shugart's SA850R (–63 interface). The unit is also IBM information and media compatible. Electronic functions and logic controls are LSI-microprocessor based for signal and data integrity. Two all-ferrite MnZn heads in a special-designed gimbal mounted assembly enable soft, stable contact with media regardless of disk surface fluctuations thus eliminating possibility of media damage. Mitsubishi Elec-



tronics America, Inc., Computer Peripherals Div., 2200 W. Artesia Blvd., Compton, CA 90220, (213) 979-6055.
CIRCLE INQUIRY NO. 227

Product development package has all the necessary features of the development system to prototype a microprocessor based product. The Z-80/PDP has user insertable breakpoints, single step, memory/register examine, and a built in PROM programmer. All the additional hardware for the prototype can be placed on the ample wire wrapping area in the Z-80/PDP. S-100 products can be tested or added using the S-100 interface connectors on the development package. The Z-80/PDP may be linked to a CP/M based system with a single serial port. One writes the program using a sophisticated editor, debugger, and simulator. The program is down loaded to the Z-80/PDP with a single

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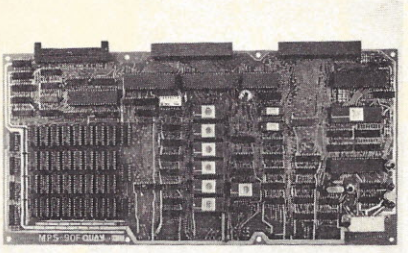
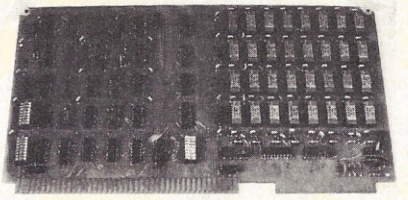
operation. It can be immediately burned on PROM and/or debugged further. Price: $1,590. Americomp Consulting Co., GPO Box 2238, New York, NY 10116, (212) 477-1403.
CIRCLE INQUIRY NO. 228

Single board microcomputer utilizes a Z-80, 8-bit microprocessor and features 65K-byte dynamic RAM, disk controller and DMA on-board. The 90MPS machine includes uvePROM with programmer; 1K-byte static



RAM; up to eight 8-bit programmable I/O ports; four counter/timer channels; up to three serial ports; 2.5MHz or 4MHz operation and a powerful PROM-resident system monitor. Quay Corp., P.O. Box 783, 527 Industrial Way W., Eatontown, NJ 07724.
CIRCLE INQUIRY NO. 229

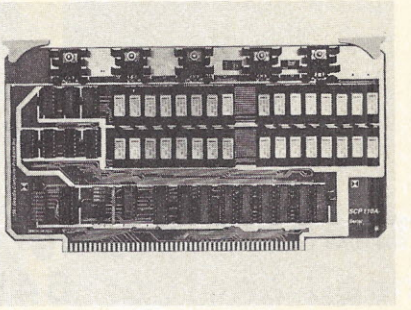
Memory module features easy expansion to 32K, 48K or 64K bytes on a single board. The new memory is compatible with both 8-bit and 16-bit multibus based systems. The CI-8080 is designed to plug directly into the memory slot of the MDS 800 and the SBC 80/10. The module allows maximum processor throughput with the use of on-board refresh control logic. Data access



time is 270 nS and cycle time is 400 nS. The memory is addressable in 4K increments up to 64K words of memory. It is available with battery backup capability. The CI-8080 size is 6.75 in. by 12 in., while power consumption is under 7 watts. Prices: $475 for 16K by 8; $575 for 64K by 8. Chrislin Industries, Inc., Computer Products Div., 81852 Via Colinas, #102, Westlake Village, CA 91351, (213) 991-2254.
CIRCLE INQUIRY NO. 230

CPU card, a Z80-based unit configured in the STD bus design, features up to 4K of EPROM and up to 4K RAM by means of jumper selection. An on-board RS-232 serial port with switch selectable baud rate permits use in stand alone applications. With card cage and support cards it may be expanded as large as needed for almost any application. Price for the 2MHz version (model 2007): $159; the 4MHz version (model 2007A): $169. Robotics Technology, Inc., Box 401411, Dallas, TX 75240.
CIRCLE INQUIRY NO. 231

Static 64K RAM, SCP-110, IEEE S-100 memory card uses the 100 nS Intel 2167 16K static chip. The chip allows memory management functions of offset and protection to be performed with the firm's 8 MHz 8086 CPU without a wait state. The card performs both 8-bit and 16-bit transfers, switching automatically. The chips are used



in a power down mode to minimize current. Power requirements for an active board are 1.6 amps at 8 V while an inactive card uses 0.8 amps. The card uses 24-bit addressing, the upper eight of which can be disabled. Price: $1,295. Seattle Computer Products, 1114 Industry Dr., Seattle, WA 98188, (206) 575-1830.
CIRCLE INQUIRY NO. 232

Disk storage modules, the 9670 series, consists of several configurations of disc and tape storage devices that can be

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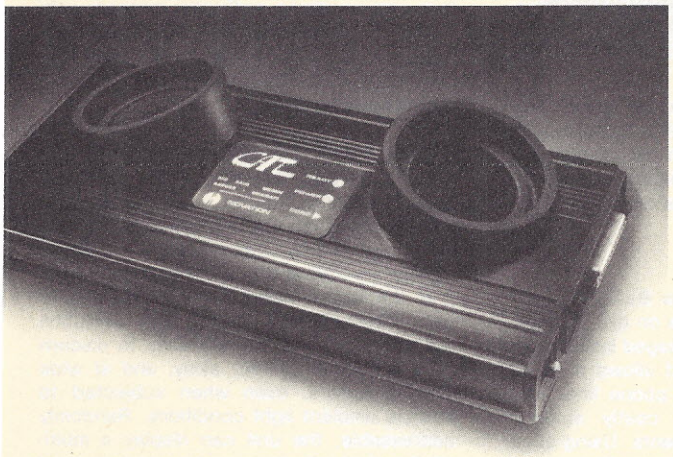

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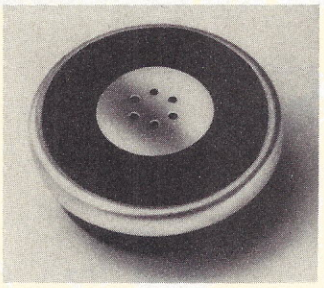

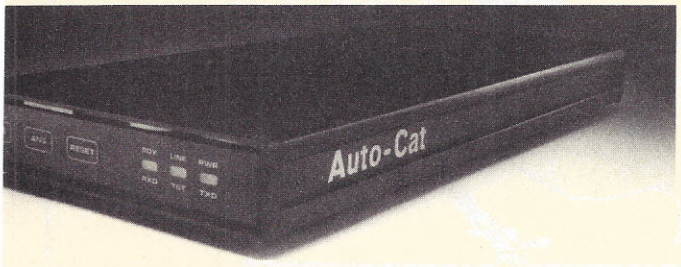

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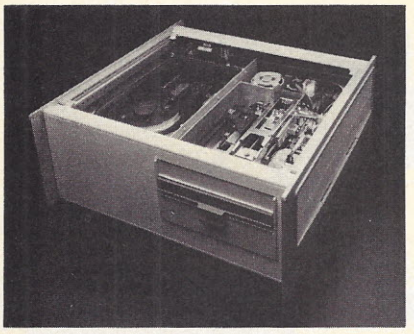
uniformly interfaced on the M6800/6809 microprocessor bus. Each configuration is a complete storage system with one or more drives, an intelligent controller and a power subsystem packaged in an attractive enclosure. Also included with the system is a



host adapter to provide the bus interface to the controller. The 9670 host adapter is pin and outline compatible with the Motorola Exorciser, Micromodules and other industry standard cards. Price: $5,295 for the 10M-byte Winchester - 1M-byte floppy configuration. Creative Micro Systems, 11642-8 Knott St., Garden Grove, CA 92641, (714) 898-9669.

CIRCLE INQUIRY NO. 233

Direct connect modem connects TRS-80 computers and similar devices directly to standard single-line telephones, using the small plug-in modular jacks with which most current telephones are equipped. The Modem I gives computer users an inexpensive method of enjoying the many over-the-phone services available, including information networks, as well as providing a means of telephone communications with other computers. The direct connection technique

eliminates the data losses and errors that can be caused by microphonics in an acoustic coupler, which result from the bumps and noises picked up by the telephone receiver. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

CIRCLE INQUIRY NO. 234

FCC approved modem is Bell 202 compatible in half duplex mode on dial-up lines. The 1200 baud unit is packaged inside each Datacorder (1 and 2), and allows it to be connected directly to the phone line. This eliminates the need for costly external modems or phone instruments. Using soon to be released versions of the Bisync and Burroughs communications programs, the unit is able to dial a pre-configured or operator entered phone number, or auto answer an incoming call. The 1200 baud options list for $495 on both units. International Entry Systems, 408 N.E. 72nd St., Seattle, WA 98115.

CIRCLE INQUIRY NO. 235

Bi-lingual CRT terminal is specifically designed for Arabic speaking computer environments. The Hyder Terminal 400 has the capability of switching between Arabic and Latin modes. This intelligent terminal automatically modifies Arabic characters to their proper form, dependent upon their location in the word, with diacritic composition and proportional display. The terminal is capable of displaying characters in Latin or Arabic character sets, using either the English language insertions, or English language with Arabic language insertions. Price: $3,950. NAE Int'l., 6814 San Fernando Rd., Glendale, CA 91201, (213) 841-1302.

CIRCLE INQUIRY NO. 236

Display panel, the itron DM256X64A, consists of 16,384 fluorescent 0.4 millimeter square dots arranged in a 256 vertical-row and 64 horizontal-row configuration that fills an active display area measuring 166.15 millimeters long and 41.35 millimeters wide. It is the largest display unit introduced to date. The unit emits bright, high-resolution dot matrix images that are easy to discern from a number of feet away, and at wide viewing angles, even when subjected to intense ambient light conditions. Randomly addressable, the unit can display a multiplicity of visualizations such as: cursive and block alphanumeric messages in a variety of sizes and shapes, graphic line and filled-in area pictorializations, symbols, geometric patterns, etc.—in a number of combinations that can be scrolled from side-to-side or up-

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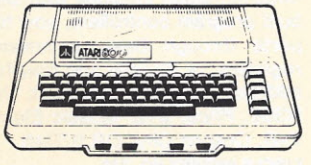

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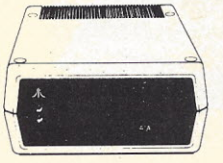

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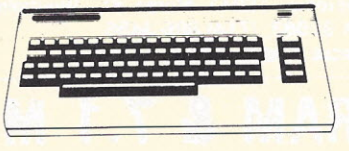

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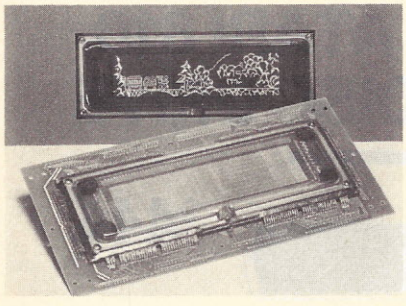
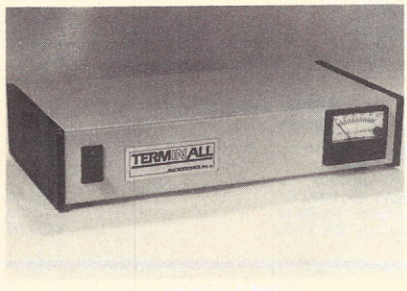


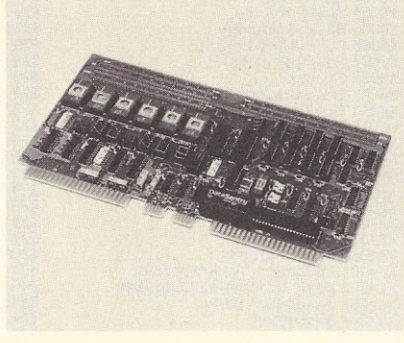
the display of optimum brightness blue-green images, even though the 0.4 square millimeter fluorescent dots are spaced only 0.25 millimeters apart. Noritake Electronics, 22410 Hawthorne Blvd., Torrance, CA 90505, (213) 373-6704.
CIRCLE INQUIRY NO. 237

Integrated hardware/software system converts the TRS-80 model I or III into a



communications terminal. Terminall includes all the necessary computer interfacing, audio demodulating, AFSK tone generating and transmitter keying hardware integrated in one cabinet. This reduces equipment interconnection to a minimum and allows the operator to be on the air receiving and transmitting Morse or RTTY in minutes. Plug it into the receiver headphone jack and copy Morse code, Baudot or ASCII. Plug it into the CW key jack and send Morse code. Attach a microphone connector and send Baudot or ASCII using audio tones (AFSK). The unit comes complete with software on cassette and disk, assembled and tested hardware, and an extensive instruction manual. Price: $499. Macrotronics, 1125 Golden State Blvd., Turlock, CA 95380, (800) 344-7493.
CIRCLE INQUIRY NO. 238

Printed circuit boards, series 100, expand memory and I/O performance of the Aim 65 microcomputer. The basic UDS-100 has two independent, baud rate selectable, asynchronous, serial RS-232-C channels and 20 independently programmable parallel I/O lines. Sockets are provided for eight 1K by 4 static RAMs and six 2K by 8 EPROMs. DIP plug jumpers allow reconfiguration for higher



density memory devices. Boards interface directly to the Aim 65 without bus buffering and can be mounted within UDSI's ACE-100 enclosure. On-board prototyping area for custom circuitry is also provided. Options include battery backup for CMOS RAM and units with RAM/EPROM included. Dimensions are 6.5 in. by 11 in. Price: $295. Unique Data Systems, 15041 Moran St., Westminster, CA 92683, (714) 895-3455.
CIRCLE INQUIRY NO. 239

I/O package can help give the Atari computer direct ties to the real world. The four ports on the front of the computer connect directly to a PIA for use as output as well as input ports. Now Atari owners can build custom program controllers, interface to home control circuits, or use any hardware the imagination can devise. The I/O package comes with four 9-pin connectors, four 12-in. lengths of nine conductor ribbon cable, and complete instructions for their use. The documentation includes examples of home-built program controllers, how to access the ports through Basic commands, shadow registers, or directly and how to set up and address the ports for output. Order number H309. Price: $18. Mosaic Electronics, Box 748, Oregon City, OR 97045.
CIRCLE INQUIRY NO. 240

Graphics controller, the RGB-Graph, is a 512 by 512 pixel by 4 bit single board color video display. The unit is a Multibus compatible plug-in board. Connections are provided for RGB color and monochrome video monitors, a high-speed light pen, and an expansion port (which permits additional slave RGB cards to be added for increased color and/or display resolution). The unit produces a bit-mapped display with various user selectable resolutions. Each pixel can be addressed via a pair of X and Y position registers that feature an auto-increment/decrement capability for high speed vector drawing and DMA control. The board also incorporates several advanced hardware features including zoom, shift, pan, scroll, clear, clip, mask and overlay. In addition, all video parameters, such as horizontal/vertical syncs, blanks, refresh rate, etc., are software programmable, enabling the user to drive almost any B/W or color monitor. High level graphics software packages for Z80 or 8086 based CP/M systems are available for the unit. Matrox Electronic Systems, 5800 Andover Ave., T.M.R., Montreal, Quebec, Canada H4T 1H4.
CIRCLE INQUIRY NO. 241

Type ahead buffer, model 150, is compatible with all Apple II computers and software. Featuring a 40-character type ahead capability, the unit eliminates the

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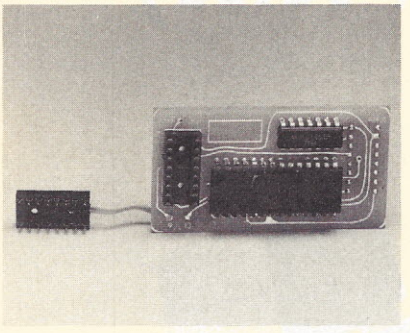
need to wait for computer prompts before entering the next command or data. Thus, it promotes a more personal Apple II computer



and provides a means for achieving maximum clerical efficiency. The model requires no software patches, cuts or jumpers. Its simplified design affords virtually effortless installation. Price: $50. Vista Computer Co., 1317 E. Edinger Ave., Santa Ana, CA 92705, (714) 953-0523.

CIRCLE INQUIRY NO. 242

Color printer interface, Cprint, gives your TRS-80 color a plug compatible Centronics type parallel printer port for use with all parallel Radio Shack, Centronics, Epson and similar printers. Software contained in permanent on-board memory gives transparent operation with several added features: 1) all LLIST and PRINT # – 2 output is automatically rerouted; 2) a screen-print function can be initiated at any time; 3) line width can be set; 4) the graphics in the LPVII can be accessed; 5) page length can be set, and 6) blank lines are inserted between pages. Using a parallel port, print speed is not slowed by the standard 300 baud serial interface. The module also eliminates the need to pay the $40-100 extra that many manufacturers charge to add a serial interface to their printers. The module is a fully buffered 8-bit I/O port that will interface with any model I/III products that plug into the printer port. An example is the Percom speech board. The unit is compatible with all versions of the color computer and uses no extra memory. Price: $50. Micro-Labs, 902 Pinecrest, Richardson, TX 75080.

CIRCLE INQUIRY NO. 243

Article surveillance system, Safekeeper, is a low-cost, self-contained system designed to maintain control of computer tapes, printouts and other documents and detect unauthorized removal of these materials from restricted locations. The system employs the same technology as other systems used by major retailers around the world for protection against shoplifting. A tag containing an electronic chip is attached to an article, coordinated sensing devices are positioned at exits and an alarm sounds when a tagged

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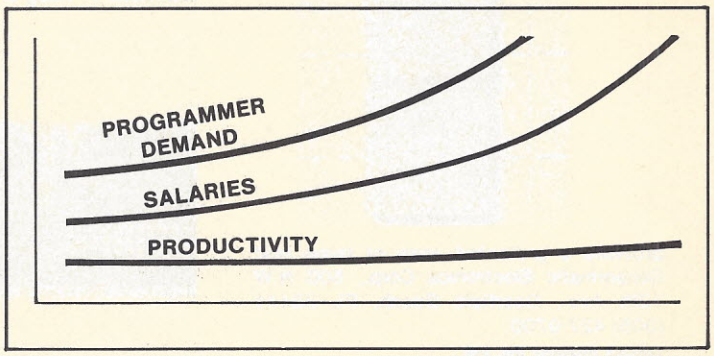

company's strengths and weaknesses. This behind-the-scenes information gives you important facts to consider when evaluating products critical to your company's future. SOFTWARE also supplies management tips, analyses of legal issues, summaries of important news and product announcements, interviews with industry experts, and valuable software buyer's checklists.

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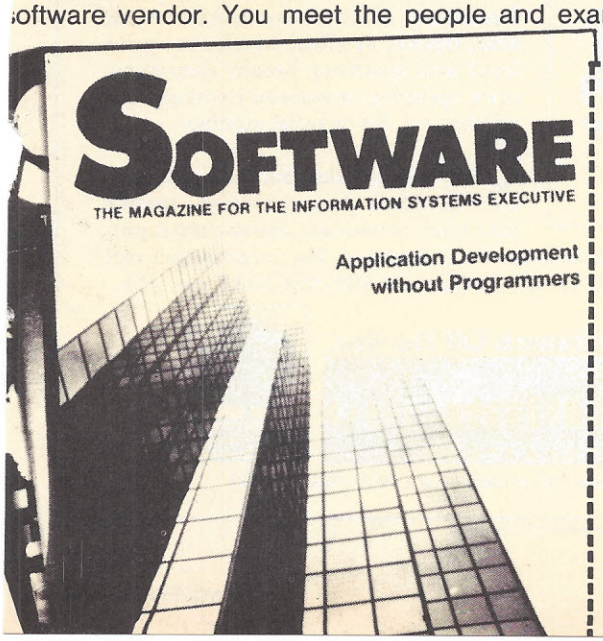

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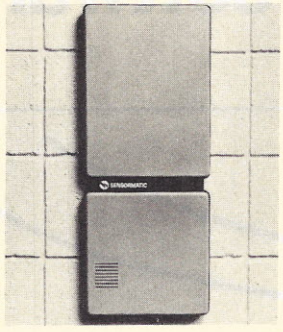
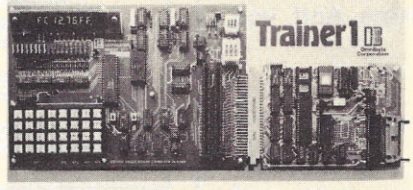
article is detected at an exit. The system utilizes small, pliable adhesive-backed tags that adhere to any surface. The compact sensing device is easily self-installed at a door or exit area in just 10 minutes and



provides a protected zone of three feet. Sensormatic Electronics Corp., 500 N.W. 12th Ave., Deerfield Beach, FL 33441, (305) 427-9700.

CIRCLE INQUIRY NO. 246

Microprocessing training module, Omnibyte Trainer 1, is designed to guide its user from a beginner status to a comprehensive understanding of microcomputer systems. Because of its unique design, the unit is capable of growing as the user's skill develops. The training module can be easily expanded from a fundamental teaching unit to a complete disc-based system. At the heart of the 2-board system is the OB8001A single board computer. The OB8001A is built around the MC6808 CPU, and has 1¼K of onboard RAM, provisions for up to 4K PROM, onboard I/O capability, and is compatible with all Omnibyte I/O and memory boards. When unplugged from the trainer interface board, the OB8001A will function as a stand-alone computer, or can be used to control a complete microprocessor system. The trainer interface board features a large 8-digit display, LSI keyboard encoder, separate command/data keys, and a hexidecimal keypad with positive tactile feedback. A TBug 2K-byte monitor program



and hardware trace circuitry gives the user complete control over the system. Prices range from $349.95 to 526.45. Omnibyte Corp., 245 W. Roosevelt Rd. (I-5), W. Chicago, IL 60185, (312) 231-6880.

CIRCLE INQUIRY NO. 248

High speed shredders eliminate stacks of continuous forms quickly and efficiently. Destroyit Data 16-in. shredders include standard and economy models. The standard model with 1½ H.P. motor is the fastest machine of its size, devouring over 100 ft. of continuous forms per minute or a stack of 30 letterheads. The economy model with 1¼ H.P. motor is approximately 20% slower. These shredders look alike and each comes

with the same super strong 3 shelf metal stand for faster, more convenient feeding of multiple stacks of continuous forms. An easily attached, oversized shred-bag holds a huge volume of shredded material. These machines are easily moved on large casters and can be brought to the work where they perform quietly and efficiently, destroying unending amounts of obsolete documents, papers and forms. Electric Wastebasket Corp., 145 W. 45th St., New York, NY 10036.

CIRCLE INQUIRY NO. 249

Printer interface option connects to IPS-5000 and IPS-5000-A intelligent dot matrix units. The integrated RS-232 serial communications combines the serial function with a buffer capacity of 1K, 2K or 4K of RAM on one I/O board. The unit incorporates individual microprocessors to transmit and handle X-ON/X-OFF communications protocol; this construction also gives more flexibility for

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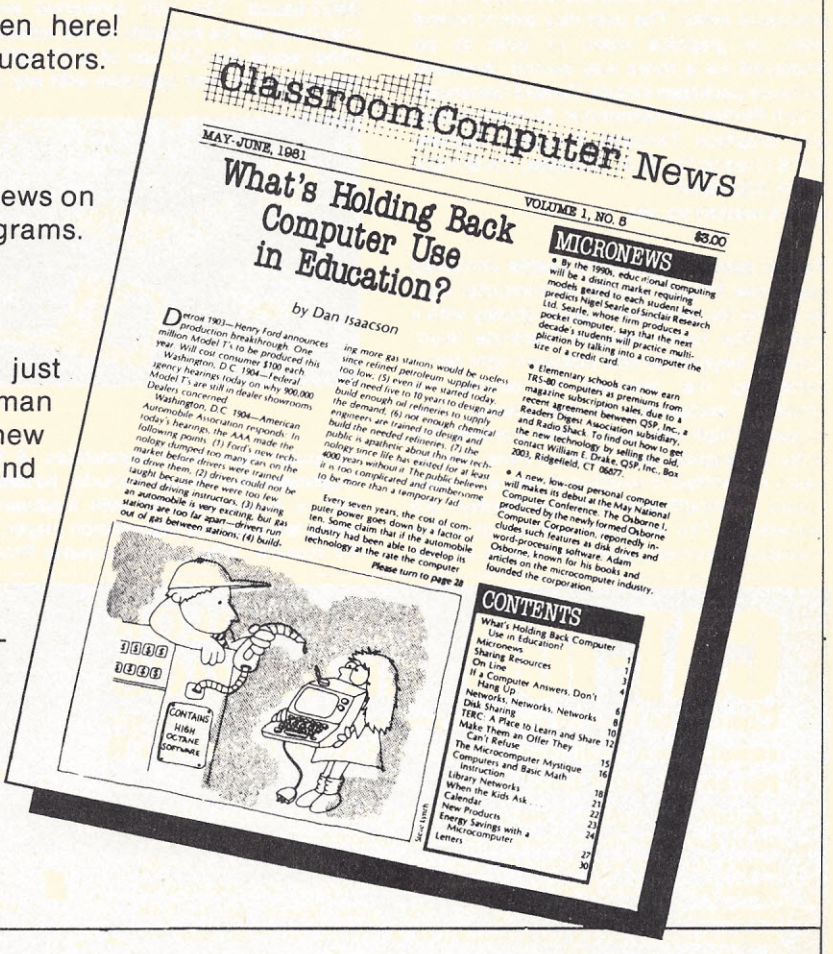
Classroom Computer News

MAY-JUNE, 1981

VOLUME 1, NO. 6 $3.00

What's Holding Back Computer Use in Education?

by Dan Isaacson

Detroit 1901—Henry Ford announces production breakthrough. One million Model T's to be produced this year. Will cost consumers $100 each.

Washington, D.C. 1904—Federal agency hearings today on why 900,000 Model T's are still in dealer showrooms. Dealers concerned.

Washington, D.C. 1904—American Automobile Association responds to today's hearings. The AAA made the following points. (1) Ford's new technology dumped too many cars on the market before drivers were trained to drive them. (2) drivers could not be taught because there were too few trained driving instructors. (3) having an automobile is very exciting, but gas stations are too far apart—drivers run out of gas between stations. (4) building more gas stations would be useless since refined petroleum supplies are too low. (5) even if we started today, we'd need five to 10 years to design and build enough oil refineries to supply the demand. (6) not enough chemical engineers are trained to design and build the needed refineries. (7) the public is apathetic about this new technology since life has existed for at least 4000 years without it. The public believes it is too complicated and cumbersome to be more than a temporary fad.

Every seven years, the cost of computer power goes down by a factor of ten. Some claim that if the automobile industry had been able to develop its technology at the rate the computer

Please turn to page 28

MICRONEWS

• By the 1990s, educational computing will be a distinct market requiring models geared to each student level, predicts Nigel Searle of Sinclair Research Ltd. Searle, whose firm produces a pocket computer, says that the next decade's students will practice multiplication by talking into a computer the size of a credit card.

• Elementary schools can now earn TRS-80 computers as premiums from magazine subscription sales, due to a recent agreement between QSP, Inc., a Readers Digest Association subsidiary, and Radio Shack. To find out how to get the new technology by selling the old, contact William E. Drake, QSP, Inc., Box 2003, Ridgefield, CT 06877.

• A new, low-cost personal computer will make its debut at the May National Computer Conference. The Osborne I, produced by the newly formed Osborne Computer Corporation, reportedly includes such features as disk drives and word-processing software. Adam Osborne, known for his books and articles on the microcomputer industry, founded the corporation.

CONTENTS

unique or future printing/communications applications. The unit accepts data at rates up to 9600 baud. Installed inside the printer, the integrated board connects to the main board via the 20-pin interface board cable. Price: $150. Dataroyal, 235 Main Dunstable Rd., Nashua, NH 03060, (603) 883-4157.
CIRCLE INQUIRY NO. 250

Graphics conversion unit, the Xcel, allows Z-89/H-89 and Superbrain microcomputers to display 16K pixel graphics with 512 by 240 lines resolution. The low cost unit can be installed in less than one half hour and allows full memory capability of the host processor to remain intact. Graphics video is independently controlled and overlays normal processor video. The user may select normal video or graphics video or both to be displayed via a three way switch. Available software packages include Symbol Generator, Graph Plotter, 3D Generator, Surface Plotter and Graphics Terminal Emulator. Martek, 2908 Oregon Ct., G-3, Torrance, CA 90503, (213) 320-6604.
CIRCLE INQUIRY NO. 251

Touch screen digitizers enable untrained personnel to gain access to computer data by simply touching a computer display with a finger. The touch screens eliminate fixed-function keyboards with awkward light pens, permitting the operator to devote his attention exclusively to the display. The screen's high resolution also permits the entry of graphic data. The screens can be easily retrofitted to existing displays. In most cases, no modifications to the displays are necessary. The digitizers consist of a thin transparent curved panel that mounts in front of a standard 12 or 15 inch CRT display monitor and an electronic board that is connected to the panel with a cable. When the panel is touched, the location of the touch is measured and sent to a host computer as a RS232C message. The digitizer thus acts as a data entry device, replacing a keyboard or graphic tablet. Prices: $650 for 12-in. model (TF-12)P; $700 for 15-in. model (TF-15)P. TSD Display Products, 35 Orville Dr., Bohemia, NY 11716, (516) 589-6800.
CIRCLE INQUIRY NO. 253

Intelligent interface unit allows read-only video disks to be controlled from a computer's keyboard. The interface unit is 6802-based. The UEI (universal external interface) will be available in two versions for either serial RS-232 use of IEEE 488 bus-based sytems, and operates with any micro-

computer have such capabilities. A typical implementation would include, besides the UEI, a microcomputer with keyboard and video terminal, the DiscoVision player, and a TV monitor. SSM Microcomputer Products, 2190 Paragon Dr., San Jose, CA 95131, (408) 946-7400.
CIRCLE INQUIRY NO. 252

Cleaning kit, Vari-Clean, has been designed for the small computer user, the word processing user or the terminal user. It contains components to clean all of the various components of a user's system, from the CRT screen, to the printer, to the heads of the magnetic peripherals. It even contains an anti-static spray that, when

applied to carpeting, reduces static electricity in extremely low humidity conditions. Price: $40. Innovative Computer Products, 18360 Oxnard St., Tarzana, CA 91356, (213) 996-4911.
CIRCLE INQUIRY NO. 244

Digital cassettes have been selected and certified for storing twice the normal bit density. Each cassette is certified for 0 errors at 3200 fci (1600 BPI) and is guaranteed to remain that way for one full year. To complement this line, MIS will also supply pre-record

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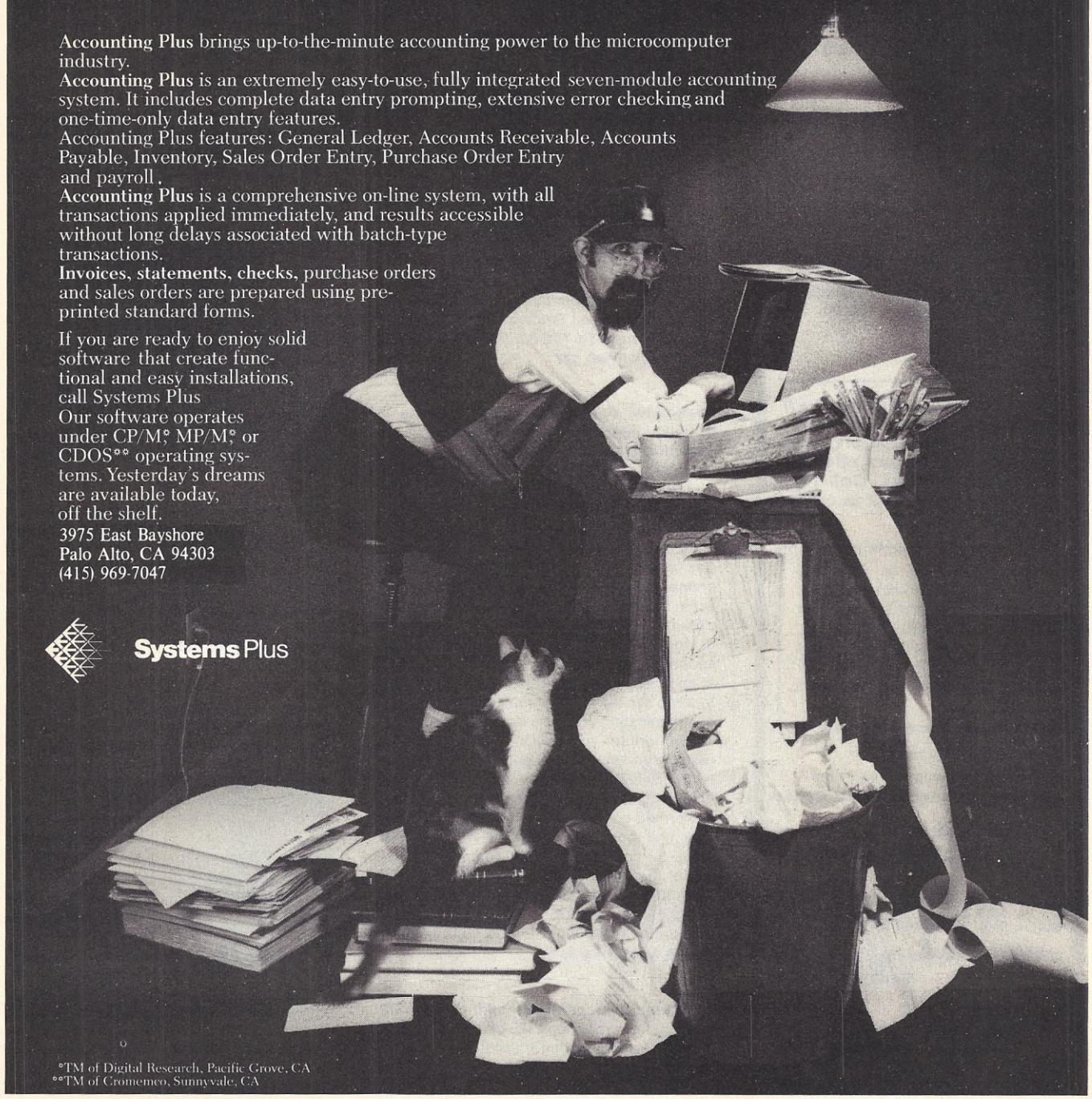

*TM of Digital Research, Pacific Grove, CA
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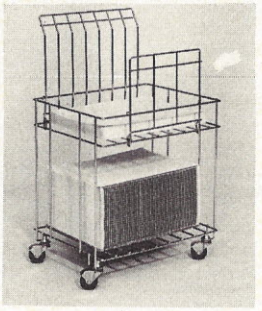
alignment tapes that will allow its customers to calibrate their machines at this higher

storage capacity. MIS, Box 806, 415 Howe Ave., Shelton, CT 06484, (203) 735-6477.
CIRCLE INQUIRY NO. 245

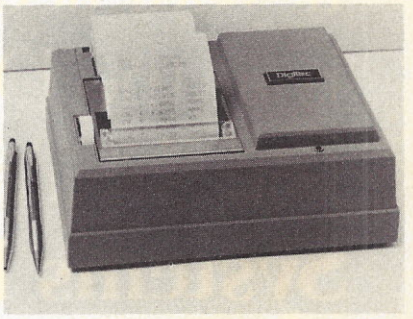
Mobile forms rack is chrome plated and assures convenient feeding and retrieval of forms. It is mobile, but equipped with locking



casters. Special paper guides fold for shipping and storage. Royal Seating Corp., P.O. Box 753, Cameron, TX 76520, (817) 697-6421.
CIRCLE INQUIRY NO. 247

Peripheral controller, model PC-2, is a versatile interface unit that provides an economical means to cluster up to six CRT or printing terminals on a single port, or up to six CRTs on a single hard-copy printer. The unit operates on the principle of contention-logic. When it is used as a terminals-to-computer interface, the press of a button at any one of the input terminals logically connects that terminal's communications lines to the computer port, and logically excludes the other terminals. Another press of the button frees the computer to be accessed by another terminal. An LED (one at each terminal) indicates the particular unit that has access to the computer. The terminal communication lines are logically connected to the printer and X On/X Off, suspend/resume codes can be sent from the printer to the selected terminal. The bi-directional model PC-2 replaces the earlier PC-1 that performed only the CRTs-to-printer function. The unit operates on either 120 or 240 volts, 50 or 60 Hz and consumes 7 watts of power. It measures 3 by 5¼ by 10⅜ in. (76 by 133 by 262 mm) and weighs 2.2 lbs. (1 kg). Price: $375. Teleray, Box 24064, Minneapolis, MN 55424, (612) 941-3300.
CIRCLE INQUIRY NO. 254

Alphanumeric printers print 21 or 32 columns of alphanumeric characters first-line-up like you normally read. The internal microprocessor provides these DigiTec printers 6430 and 6470 with enhanced operational and interface capabilities. Both models permit switch selectable serial or parallel input interface. Serial input may be RS-232C or optically isolated 20 mA current



loop at selectable 110, 300, 600 or 1200 baud. Parallel interface is the 8 bit parallel, character serial, bus system at up to 2000 characters/second. All interfaces respond to the popular ASCII input format. The 36 character input buffer will initiate automatic print at buffer overflow. Price: $399. United Systems Corp., 918 Woodley Rd., Dayton, OH 45403, (513) 254-6251.
CIRCLE INQUIRY NO. 255

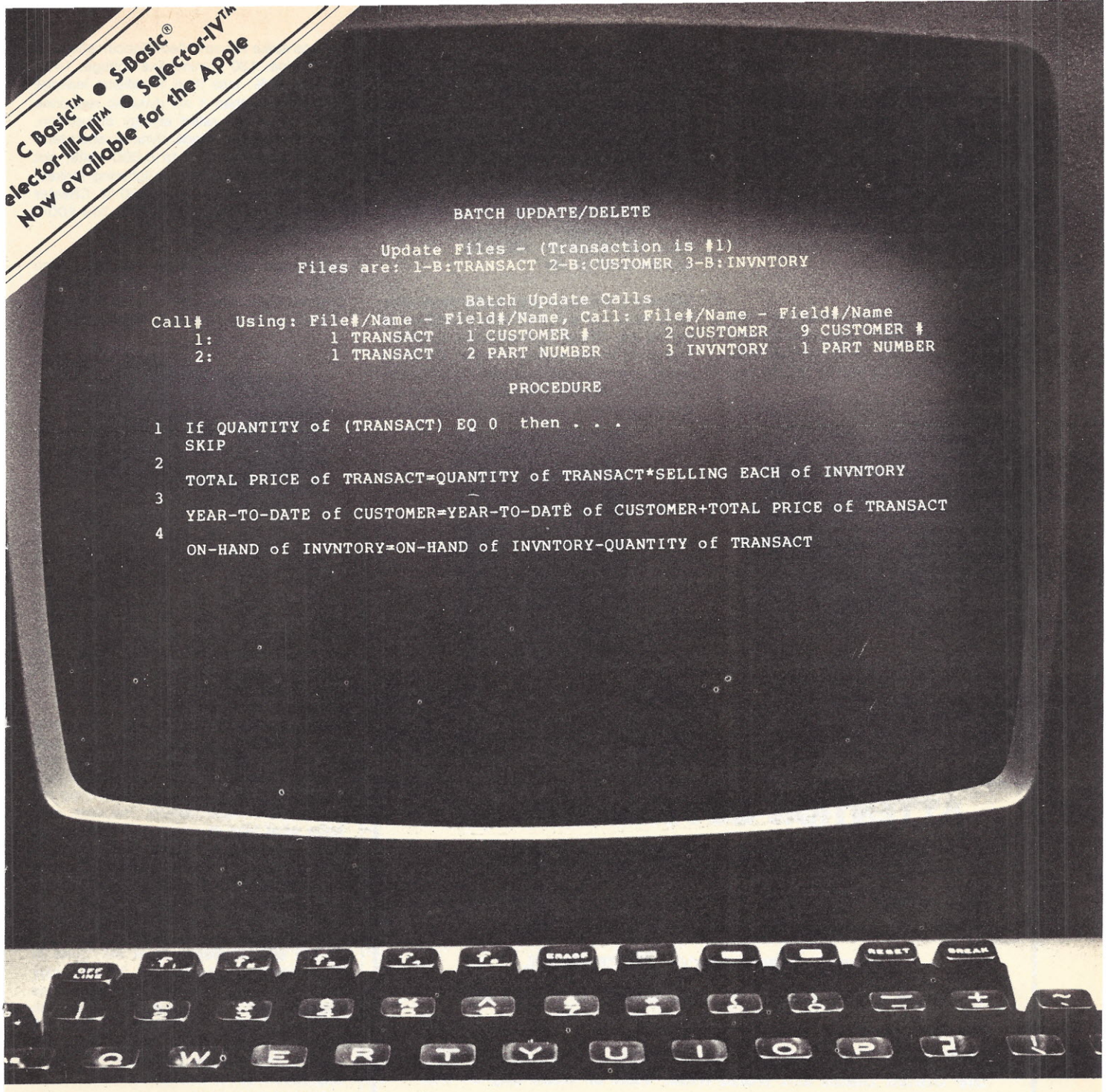
Bi-directional dot matrix printer serves data processing requirements with speeds of up to 165 characters per second in a 5 by 9 dot matrix. For document preparation requirements, the model 165 features a word processing font that prints at 90 characters

per second in a 10 by 9 dot matrix. Model 165 comes in woodgrain and solid finishes and is recommended both for commercial and personal computer applications. Price: $2,295. Malibu Electronics Corp., 2301 Townsgate Rd., Westlake Village, CA 91361, (805) 496-1990.
CIRCLE INQUIRY NO. 256

Computer in briefcase contains a word processor, an 8-in. by 8-in. viewing screen with a capacity of 480 characters, a bubble

memory and a telephone coupler. The Microdata 8400 weighs less than 17 lbs. and has a standard Qwerty keyboard. It can operate

C Basic™ ● S-Basic® ● Selector-IV™
elector-III-CII™ ● Selector-IV™
Now available for the Apple



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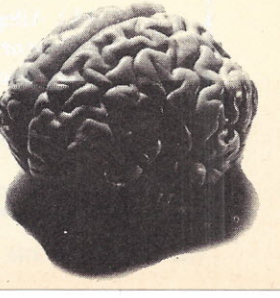

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CIRCLE INQUIRY NO. 69

anywhere because it works on power supplies from 105-265 V. The acoustic coupler allows the unit to transmit or receive data or programs over public telephone lines. It operates on both American and European communications standards. The 94K capacity bubble memory stores the data and is not erased when the power is switched off. Information cannot be extracted from the unit without the use of a password. Microdata Computers, Belvedere Works, Bilton Way, Hayes, Middlesex UB3 3ND England, 01 848 9871.

CIRCLE INQUIRY NO. 257

Microcomputer system analyzer, the RD-920, can be used in development and field service work due to its compactness and portability at 420 by 390 by 180mm and

weighing just 8 Kgs. It offers: standard 16K byte RAM; simple operational transfer of contents of tested instrument's ROM into RS-920's RAM, thus enabling RAM debugging; standard RS232C and TTL level serial interface; standard parallel interface for PTR. Main functions are: memory read and program; Out command, In command; register, read and write; programming starts at any location address; break points; execution of programming run concerning the RAM; interfacing possible for external equipment; programming load through PTR (Intel HEX object or binary object); transferring RAM into PROM programmer; interfacing with CRT terminal. Intertek, Inc., Naito Bldg. 7-2-8 Nishishinjuku, Shinjuku-ku, Tokyo, Japan 160, telephone 363-6649.

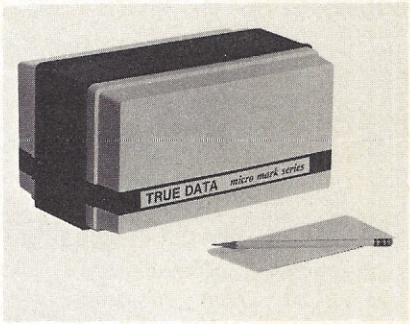
CIRCLE INQUIRY NO. 258

Transient voltage surge suppressor protects electrical and electronic equipment in homes and offices from electrical pollution. Adaptable to any standard duplex electrical outlet, the six-receptacle unit monitors and filters off damaging transient voltage spikes and surges of up to 6,000 volts. Passive to

normal line voltage, Stedi-Watt, Jr. repsonds within one billionth of a second to combat costly electrical pollution and returns with the same rapidity to a passive state after the voltage spike is controlled. Specifications of the device: 130 nominal line voltage; 185V RMS ±10%; less than 1 milliamp leakage current; less than 1 nS dynamic response time; 20 Joules rated energy dissipation; open circuit failure mode; dynamic short term current protection up to 6,000 volts; not designed to absorb direct lightning strikes. National Field Sales, Inc., 2660 W. Chester Pike, Broomall, PA 19008, (215) 359-1004.

CIRCLE INQUIRY NO. 259

Automatic optical card reader, Micro Mark II, is a low cost high speed data and program statement entry peripheral. Ideal for the education or personal computer market,



the units accept and read both marked (number two pencil) and punched cards. With a serial interface, price is $1,200; with a parallel interface, $1,500. True Data Corp., 17092 Pullman St., Irvine, CA 92714.

CIRCLE INQUIRY NO. 260

Graphic software allows the user to dump the contents of the high resolution pages (options for page 1 or page 2) out to the new Centronics printer, model 739 to obtain hard copy graphics. The options for printing are presented in menu fashion. The user must know what type of printer interface card is being used and which slot number it is in. The five types of interface cards which are supported are listed on the beginning menu. The printer interface card is standardly placed in slot #1 of the Apple II (or Apple II Plus) but the software may be set to use any of the slot numbers except #0. Used in conjunction with Apple Plot, the user may obtain hard copy of business plots as well as anything that may be loaded to the high resolution page of the Apple II or Apple II Plus computer. Price: $44.95. Computer Station, 11610 Page Service Dr., St. Louis, MO 63301, (314) 432-7019.

CIRCLE INQUIRY NO. 261

Applications package for the TRS-80 model III, Business Data Base, offers the user the dual benefits of an electronic worksheet type program (without the constraints of fixed RAM storage) and a general purpose data base and storage system. The package allows the creation of indexed data bases composed of either alpha-numeric or numeric data. The data can be filed, sorted and edited at will. Numeric data can be arranged into programmed formulas in order to develop financial forecasts, balance sheets, income statements or special financial reports. The data base can be organized in a random form, yet reports can be extracted under user control of elements and cells. The system is programmed for use in inventory control, payroll, accounts receivable, accounts payable, or general ledger applica-

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VisiCalc is a fine aid for the computation of numerical problems. But it does have two major limitations: it is available only for a small number of systems, and its use is limited strictly to numbers, not words. To overcome these substantial limitations, Lifeboat Associates introduces T/Maker II.

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Easy to learn and use. You don't have to be a programmer to operate T/Maker II. Just follow T/Maker II's easily understood and ordered instructions, set up your data in rows and columns, define the relationships and T/Maker II will do the rest: it will perform the computations and formatting necessary to prepare your document. When you're finished you can analyze your report on your screen or store it on a diskette. Or, you can have the report printed with presentation quality.

And when any changes have to be made, simply enter the new figure or relationship and tell T/Maker II to adjust and recalculate all the new results.

Editing capabilities. As a full-screen editor for word processing, T/Maker II handles text up to 255 characters wide. It includes features like text formatting and justification, centered titles, a text buffer for block moves and repeated inserts, global search and replace commands for printing your letters, reports and documents. Wide documents are supported by horizontal scrolling.

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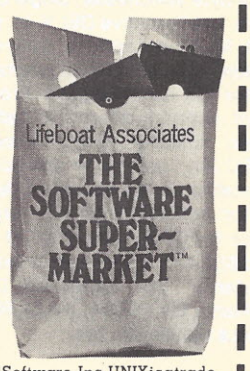

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T/Maker II is a trademark of P. Roizen. CP/M is a trademark of Digital Research, Inc. VisiCalc is a trademark of PersonalSoftware, Inc. UNIX is a trademark of Bell Laboratories. RT-11 is a trademark of Digital Equipment Corp.

As an example of what T/Maker II can do, see the chart below. The operator entered only the data shown in boldface. T/Maker II calculated and reported all the other values.

	— Actual —			Growth		Total	—Projected—		
	1978	1979	1980	Rate	Average	(000's)	1981	1982 *	1985
Item A	**42,323**	**51,891**	**65,123**	24.04	53,112	159.34	80,782	100,206	191,262
Item B	**45,671**	**46,128**	**49,088**	3.67	46,962	140.89	50,891	52,761	58,791
Total	87,994	98,019	114,211	13.93	100,075	300.22	131,673	152,966	250,053
% Item	48.10	52.94	57.02	8.88	52.69	158.1	61.35	65.51	76.49
% Item	51.90	47.06	42.98	-9.00	47.31	141.9	38.65	34.49	23.51
Total	100.00	100.00	100.00	—	100.00	300.0	100.00	100.00	100.00

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tions. Features include long fields, special report generation, and automatic recalculation of all formula related data. Price: $90. Charles Mann & Assoc., Micro Software Div., 55722 Santa Fe Trail, Yucca Valley, CA 92284, (714) 365-9718.

CIRCLE INQUIRY NO. 262

Accounting packages for the Motorola 68000 system consist of general ledger, accounts payable, accounts receivable, order entry, purchase orders, and inventory control. The system uses transaction files to update the general ledger from transactions entered in any other sub-system. With ½M byte of floppy the system will support 600 inventory items on the Altos, PDP-11, and Western Digital Microengines. Each additional ½M byte gives an additional 1000 items. Even in small systems you can have two to three hundred GL accounts, many customers and many vendors. There is essentially no limit on the number of transactions, even in the smaller systems. Al Petry, P.S. Inc., P.O. Box 2017, Fargo, ND 58107.

CIRCLE INQUIRY NO. 263

Operating system from Oasis is available for the Altos ACS8000-10 and ACS8000-10/MTU microcomputers. The combination allows flexibility in maintaining public, private or shared files with versatile user security and accounting controls on the Z80 based systems. File locking and automatic record locking insure data integrity for up to four users on the standard system. Archive and Restore—back-up utilities—support Altos 10M-byte Winchester, single 8-in. floppy disk drive, or alternative DEI ¼-in. streaming tape unit. Multi-user spooler, inter-user communication capabilities and general purpose text editor are also included. Program development support offered includes: high level Basic compiler and interpreter; powerful EXEC JCL; text editor and script processor; relocating macro assembler/debugger/linkage editor; and diagnostic/conversion programs. Price for Oasis option: $500 for single-user and $850 for multi-user versions. Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA 94621, (415) 562-8085.

CIRCLE INQUIRY NO. 264

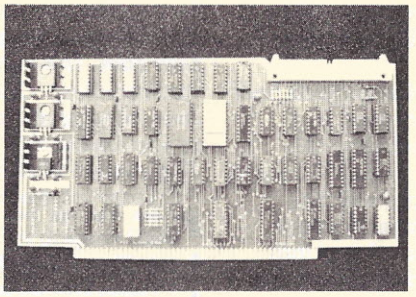
Data base management system, Pegasus, allows the user to create files, input data, query database, print reports and select subsets. It runs on UCSD Pascal operating systems and is available for the Apple II computer. Powersoft, Inc., P.O. Box 157, Pitman, NJ 08071.

CIRCLE INQUIRY NO. 265

Key-file access utility, PFAS (Pascal File Access System) version 2.0, is a set of routines written in Pascal, allowing users to write programs that access records by key. PFAS is a set of routines distributed either as a UCSD Pascal p-code unit or as a set of Pascal MT + modules that are linked to the user's program to provide key file access capabilities. PFAS allows programmers to make new files, add records either sequentially or randomly by key, read records randomly by key or partial key and read records in key-sequential or reverse key-sequential order starting with any record in the file. When records are deleted, PFAS reuses the freed-up space. Since it uses a B + tree to index the records, the file never needs to be reorganized. Added features include the support of any number of secondary key files and variable length records. In addition, the program using the PFAS routines now specifies a buffer area to be used as a disk record pool to reduce access times. The user-specified buffer pool results in a two-fold speed improvement. PFAS is available on an 8-in. soft sectored single density or an Apple II 5¼-in. floppy disk. A single-site license costs $200 and the documentation is available for $15. C.J. Wigglesworth Software, P.O. Box 755, Cardiff, CA 92007.

CIRCLE INQUIRY NO. 266

Disk interface cards are designed to control 7.1 Mbit/sec 14-in. Winchester technology drives (models 4004, 4008, 4100). The FDC4000 is capable of controlling one unmodified or up to three slightly modified drives in any combination for a maximum unformatted storage capacity of 174M bytes per card. Logically, up to 32 cards may be addressed in a single computer system. Onboard the controller is 1K static RAM



buffer, with which high speed DMAs are performed. Since the buffer is I/O mapped, no memory space is used and no wait states are generated. The support software is provided as a set of Z80 assembly language drivers, which includes a skeletal CP/M 2.2 BIOS and a skeletal MP/M 1.1 XIOS. These drivers are provided on CP/M compatible IBM standard 8-in. floppy disk. Price: $895. PCE Systems, 5232 Manzanita Ave., Carmichael, CA 95608, (916) 338-5454.

CIRCLE INQUIRY NO. 267

Graphics display terminal, the HP2623A, features a high quality display and an optional built-in graphics printer. It is well-suited to both business and technical display graphics, as well as some design applications. The 512 by 390 dot screen resolution produces an image that is bright and easy to read even in brightly lit rooms. The 2623A can draw vectors at up to 9600 baud and can be

selectively updated without erasing the entire display. Increased throughput and improved system response time result.

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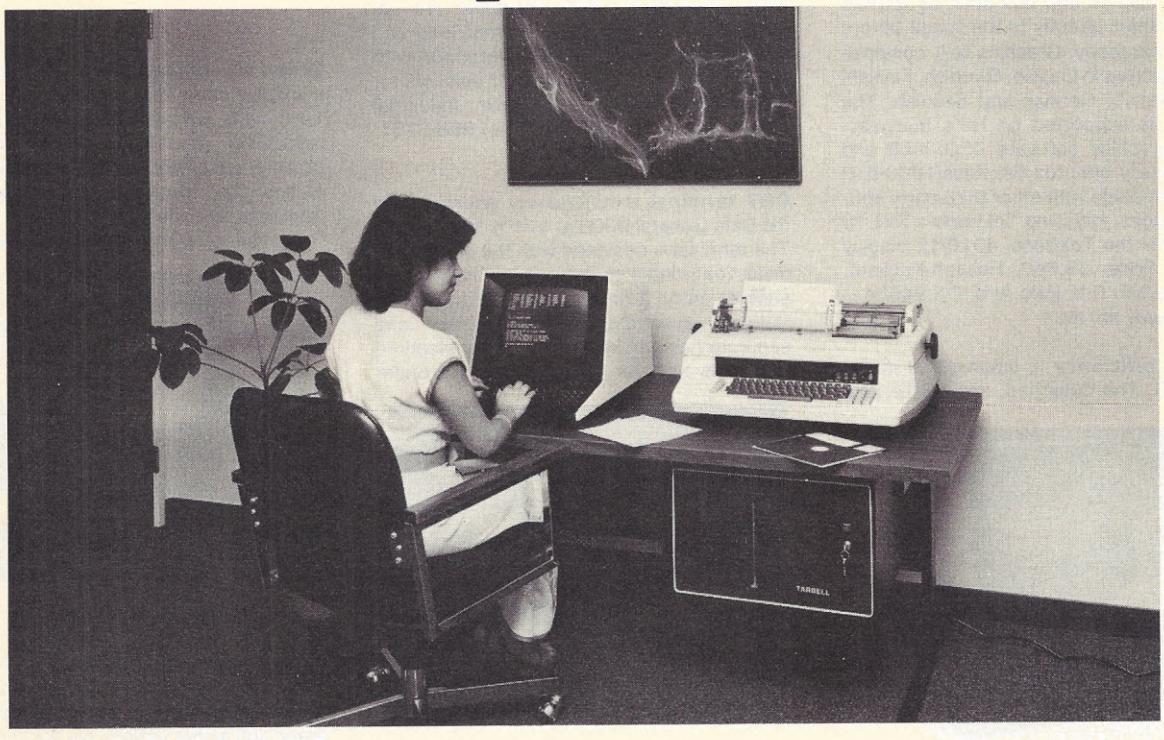

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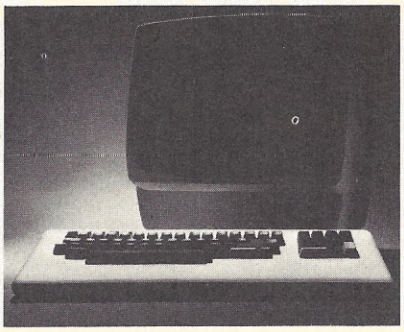
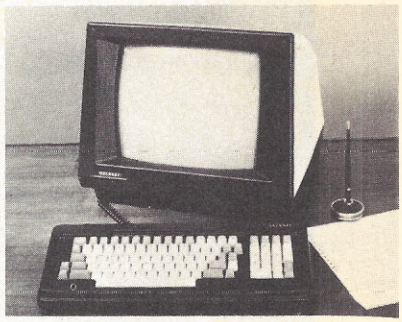
Graphic and alphanumeric memories are independent and prevent system messages from interfering with the graphics application. Local grpahics text composition and user-defined area shading are provided for greater user convenience. Graphics text composition enables a user to add text such as graphic labels and titles directly to the image before printing a hardcopy. Graphics text composition is supported in English, Swedish, Finnish, Danish, French, German and Spanish. The HP2623A is supported on HP's business-oriented graphics software DSG/3000 and the technically oriented Graphics/1000-II. It is also compatible with other third-party software packages, including Tektronix's Plot 10 software for the Tektronix 4010/12 display terminals. Price: $3,750. Hewlett-Packard, 1501 Page Mill Rd., Palo Alto, CA 94504.
CIRCLE INQUIRY NO. 268

Operator efficiency is emphasized in the Ergo 3000. The detached, low profile keyboard contains an integrated palm rest and seven LEDs to indicate terminal status. In addition, the monitor module houses a green, non-glare screen, and tilts a full 25° to accommodate any viewing angle. The terminal is fully code compatible with DEC VT-100 and offers 132-column display, scrolling regions, and double high, double wide characters. Also standard are an advanced video package, current loop and VT52 printer port. A VT-100 printer port with editing is optional. The standard unit lists for $225. Micro-Term, 1314 Hanley Industrial Ct., St. Louis, MO 63144, (314) 968-8151.
CIRCLE INQUIRY NO. 269

CRT terminal is functionally equivalent to the Data General D200 at a 35% lower price. The terminal is designed with the operator in mind, featuring a sculptured key cap set for ease of entry, a green phosphor display for reduced eyestrain, a tilting screen and separate numeric key pad. Another standard feature is a printer port that operates under program control or from the keyboard. It has two modes, page print of data displayed on the screen, and pass-through operation, which allows data from the CPU to bypass the screen and be transmitted directly to the printer. Price: $1,250 in single quantity to end users. Emulog, 3730 Yale Way, Fremont, CA 94538, (415) 490-1290.
CIRCLE INQUIRY NO. 270



Green and amber CRTs at 15 in., present a display area 30% larger than standard 12-in. units, which gives the user a significant readability advantage. Green and amber screens are easier to read for longer periods of time than black and white screens. The terminals are designed with an 18.6kHz horizontal video scan rate. CRTs are available in models 10 (single-page editor), 11 (APL/ASCII), 12 (two-page editor), 14 (extended memory, interactive) and 100 (132-columns, with non-volatile programmable functions). Add-on quantity-one prices for the 15-in. green and amber options are $200 and $215. Teleray, Box 24064, Minneapolis, MN 55424, (612) 941-3300.
CIRCLE INQUIRY NO. 271



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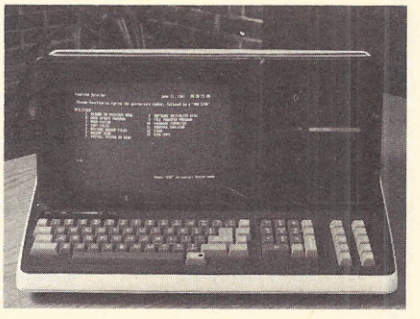
Winchester-based system, the Chieftain 98W30, houses a 30M-byte 8-in. disk drive. The system is configured around the 6809 processor and runs at full 2MHz operation.

The system uses standard back-up of 1M-byte 8-in. double side, double density floppy. A 20M-byte tape streamer can be integrated for backup at the users option. The system runs the Unix-like OS-9 multi-user, multi-tasking operating system. A standard system incorporates 32K of RAM—expandable up to 1M byte for applications that require large amounts of RAM, such as level II of the OS-9 multi-user series. The DOS69D single-user operating system comes standard. Price: $9,995. Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91361, (213) 889-9340.

CIRCLE INQUIRY NO. 272

Technical desktop computer, MPT/100, can be used for program development in Fortran IV, Basic, Pascal and assembly languages, with the MP/OS operating system. Applications include engineering and scientific computations, laboratory automation, medical diagnostics, data acquisition and process control, numerical control and remote data entry. The system is a member of the MPT family of 16-bit desktop computers. It has 64K bytes of local memory and 716K bytes of minidiskette storage in a compact desktop



package. For ease of use, it has a 12-in. green phosphor video screen, 83-key keyboard and two 5¼-in. floppy diskette drives. The system has two RS232-C programmable sync/async ports. Combined with extensive software, languages and utilities, this provides the capability to emulate most industry-standard communication protocols. Software utilities include linkers, editor, debugger, and file transfer programs. Price: $5,350. Data General, Route 9, Westboro, MA 01581, (617) 366-8911.

CIRCLE INQUIRY NO. 273

Multi-user system, the Mariner series, is a modular system that uses 8-bit technology. Instead of funneling all system functions through a single processor, each user is

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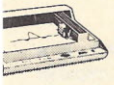
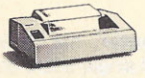


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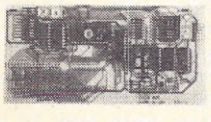
your Apple II computer to a larger world. With the Z-80 Soft- and 16K RAM Card you can now run CP/M compatible software, id your memory for specific application, act as a firmware card nuch more. If you add any boards to your Apple this year these ne ones.

VIDEX 80 x 24 VIDEOTERM AND KEYBOARD ENHANCER

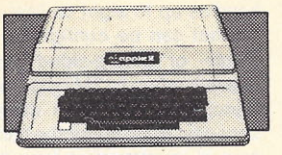
$269.00 Videoterm | **$110.00 Keyboard Enhancer**

ALS "Smartern" 80 column card $295.00

tain optimum software compatibility industry wide. By adding the oterm 80 x 24 videoboard and keyboard enhancer your Apple acts ar to CRT Terminals on larger systems. Combine this with the osoft Softcard and you've got some system.

APPLE II COMPUTER

$1069.00 16K Apple II Plus



48K Apple II "Plus" w/factory warranted RAM

$1129.00

What can we say except that it's a super system at a steal of a price.

•AppleSoft Firmware	$149	•Disk II w/cont.	$509
•Centronix Printer Int.	$179	•Disk II 2nd	$445
•Communications Card	179	•Hand Controllers	27
•High speed serial Int.	155	•Vinyl Carrier	33
•Pascal Lang. Syst.	379	•Joystick II	45
•Integer firmware	149	•Graphics Table	665
•Parallel Print.Int.	149	•Silentype Printer 365	

OTHER APPLE PRODUCTS

California Computer Systems:

• 12K PROM/ROM Brd	CALL	• Asynchronous Serial	$129
• Centronics Cable	$30	• Synchronous Serial	$149
• Calendar Clock	$99	• Parallel Interface	$99
• Programmable Timer	$89	• Centronics Interface	$99
• A/D Converter	$95	• Arithmetic Proc/Disk	$325
• GPIB IEEE 488	CALL	• Arithmetic Proc/ROM	$345

Mountain Computer Inc.

• Apple Clock	$210	• Music System	$465
• Supertalker	$255	• A/D + D/A	$299
• Romplus	$131	• Keyboard Filter	$48
• Romwriter	$152	• Keyboard Filter	$48
• Romwriter	$152	• Copy Rom	$48
• X10 Controller	$172	• I/O Cable Assembly	$47
• X10 System	$270	• Expansion Chassis	$649
• CPS Multi-function	$239	• Card Reader	$1085

Other:

• SSM AIO	$159	• ABT Barwand	$175
• SSM A488	CALL	• KBC Joystick II	$45
• ABT Keypad	$115	• KBC Keypad II	$149
• ABT Soft Key	$145	• ThunderClock	$120

APPLE II SOFTWARE

Apple Computers:

• Apple Post	$44	• Stellar Invaders	$23
• Shell Games	$28	• Apple Plot	$57
• Apple Bowl	$23	• Adventure	$33
• DOS 3.3 Update	$57	• AP Music Theory	$47
• Apple Writer	$65	• Tax Planner	$114
• DOS Tool Kit	$65		

Personal Software:

• Visicalc 3.3	$159	• Visiterm	$125
• Desk Top/Plan II	$165	• Visiplot	$147
• CCA Data Mgt.	$84	• Visidex	$159
		• VisiTrend/Visiplot	$229

Microsoft: (requires Z80 SoftCard & CP/M)

• Basic Compiler	$296	• COBAL Language	$562.50
• Assembly Language	$94	• Fortran Language	$149.00

Peachtree/40: (requires Z-80 SoftCard & 16K RAM Card)

• General Ledger	$195	• Payroll	$195
• Accounts Rec	$195	• Inventory	$195
• Accounts Payables	$195	• Mail List	$195

Misc: (48K All or All+)

• Stoneware 'DB Master'	$179	• Software Publising Corp.	
• BPI General Ledger	$315	"PFS"	$87.50
• BPI Inventory Control	$315	"PFS: Report"	$87.50
• BPI Payroll	$315	• MicroFocus "COBOL"	$743.00
• BPI Job Cost Sys.	$315		

DC HAYES
- Micromodem II $303.00
- Micromodem 100 CALL

NOVATION
- Cat-Modem $155.00
- D-Cat Modem $155.00
- Apple Cat $328.00

OSBORNE COMPUTER $ CALL

XEROX 820 The Lowest Price - $ CALL

COMPUTER SUPPLIES:

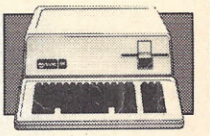
3M Scotch 5" Diskettes (10)		3M Scotch 8" Diskettes (10)	
•744-0 5" SS/SD soft sect.	$26	•740-0 8" SS/SD	$32
•744-10 5" SS/SD 10 sect.	$26	•741-0 8" SS/DD	$36
•744-16 5" SS/SD 16 sect.	$26	•743-0 8" DS/DD	$44
•7440 5" Head Clean.Kit	$29	•7400 8" Head Clean.Kit	$30

MISC.

•Silentype Paper (roll)	$4.50	•Vinyl Disk Sleeves	$6.95
•5" Vinyl disk sleeves	$6.95		

APPLE III COMPUTER

A highly sophisticated system designed to tackle the toughest budgeting, forecasting, scheduling, pricing, and other management analysis and planning tasks. It comes with a built in disk drive and interfaces and sold as a system package.



A3P000A system Option A includes: $4038.00

A3S0128 Apple III 128K
A3S0001 Information Analyst
A3M0005 12" Black & White Monitor

Accessories:
- A3M0001 Silentype Printer III $292.00
- A3M0003 Disk II for AIII $495.00

ATARI COMPUTER SYSTEMS
ATARI 800 16K Computer

Your price: **$785.00**

The Atari 800 Computer with accessories and software make up a complete system for home, educational, financial and business use.

• Atari 400	$347	•853 16K RAM Mod	$83
•810 Disk Drive	$475	•930 Acoustic Mod	$156
•815 Dual Disk Dr.	$1218	•850 Interface Mod	$60
•825 80 col.print.	$780	•410 Prog.recorder	$79

CALIFORNIA COMPUTER SYSTEM

The CCS 2210 is a low cost S100, Z80 computer system with 64K of memory, disk controller, parallel/serial I/O and CPM operating system.

$1743.00

Separate Components

• 2200A Mainframe	$373	• 24221 Disk Cntrlr.	$195
• 2810A CPU	$220	• 2718 Par/Ser I/O	$275
• 2065 64K RAM	$537		

VIDEO TERMINALS & VIDEO MONITORS

Sanyo:

• 12" Green Monitor	$269
• 12" B&W Monitor	$239
• 13" Color Monitor	$432
• 9" B&W Monitor	$169
• 9" Green Monitor	CALL

AMDEK:

• 12" B&W Monitor	$144
• 12" Green Monitor	$174

NEC:

• 12" Green Monitor	$282
• 12" Color (RGB)	CALL
• 12" Color Monitor	$402

VIDEO TERMINALS:

• ADDS Viewpoint CRT	$582
• Soroc 130	$595
• Televideo	$595

EPSON PRINTERS
MX-100

Your price **$759.00**

Probably the best buy in a printer this year. Compare features with any other and compare price (especially ours). 4 character sizes all may be placed into letter quality enhanced mode. Friction and removable tractor, 9 by 9 to 18 by 18 dot Matrix, logic seeking, and much more. Not to mention DOT PLOTTING?GRAFTRAX option built right in. **WOW! What a printer!**

• MX 80 FT Printer	$569	• MX Ser.Interface Opt	$65
• MX 80 Printer	$479	• Epson Apple Par.Int.	$69
• MX 70 Printer	$394	• Epson Par.Cable	$22.50
• MX 80 Ribbons	$14	• MX-80 or 80/ft Graftrax ROM	$78

ALTOS COMPUTER SYSTEM

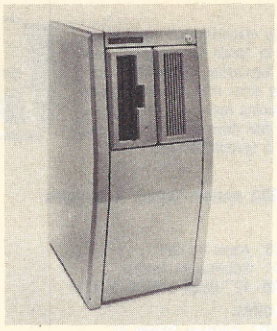
Now a system truly suited to grow with your business. Start with a single terminal system and enlarge up to 4 users. You've heard about what they can do, wait 'til you hear what we sell them for. **CALL TODAY!**

NEC PC-8000 MICROCOMPUTER SYSTEM

Not an apple lover? Check out the new NEC PC-8000–it combines the most wanted features of several leading microcomputers, together with a few wonders of its own. Go see it today, then call us tomorrow for pricing, you just might be surprised.

TERMS: Shipping: add 3% for product shipped within continental USA via UPS surface (minimum $3.00). **If the Order placed is prepaid with U.S. funds in the form of check or money order, a Total Charge of $3.00 for shipping is all you pay within the continental USA via UPS surface.** Allow 14 working days for personal and company checks to clear. Credit card charges limited to $1000. No COD's. FPO, APO or orders outside continental USA call or write for shipping charges or add 10% to purchase price (any difference will be refunded). California residents add 6% sales tax. All offers subject to change or withdrawal without notice. Warehouse: 20695 S. Western Ave., #124. Visitors by appointment.

allocated a separate satellite processor card with a Z80A and 64K bytes of



independent satellites are linked in the system via an S-100 bus to the mass storage devices and other peripherals. A master processor oversees system operation and arbitrates bus usage. The system easily handles up to eight on-line users. The single cabinet can be configured with one or two single- or double-sided floppy drives for a capacity of up to 2M bytes and an 8-in. Fujitsu Winchester hard disk drive with 21M-byte capacity. Back up for the hard disk is provided by a ¼-in. streaming tape drive. The system measures 29 in. high, 14 in. wide and 20 in. deep. It can accommodate either 110V, 60 Hz or 220V, 50 Hz power sources. Single-user system prices start at $4,500. Micro-mation, 1620 Montgomery St., San Francisco, CA 94111, (415) 398-0289.

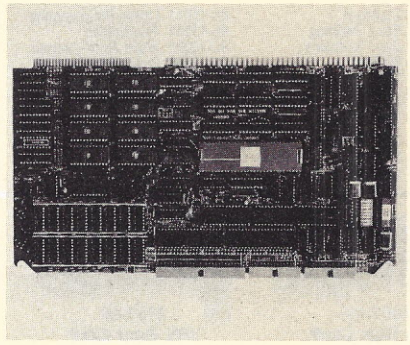
CIRCLE INQUIRY NO. 274

Compact computer, Findex, packs all the performance of a complete microcomputer system into a package that weighs only 31 pounds and is no bigger than most electric typewriters. It combines memory, a keyboard, a display, a disk drive and a printer in an enclosure that can be carried easily from place to place. The powerful computer, with a memory capacity of up to 2 million characters on minifloppy diskette drives, interfaces to a variety of outside peripherals, like larger printers or multiple hard disk drives. It has

I/O expandability: serial, parallel and S-100 bus interfaces are standard; American (Bell 103) and European (CCITT) acoustic couplers are optional. It supports a variety of high-level languages, including Business Basic, Cobol, Fortran, Pascal, APL and PL-1. And a wide variety of applications software is available including a patient accounting system for medical offices. The unit sells for $6,980-20,000, depending on peripherals and software. Findex, 20775 S. Western Ave., Torrance, CA 90501, (213) 533-6842.

CIRCLE INQUIRY NO. 275

CPU based computer, the OB68K1, is a powerful 16-bit CPU single-board unit capable of functioning as a stand-alone system, or as the central processor card in a large micro-computer system. The board can be ordered with either 32K bytes or 128K bytes of



RAM, eight sockets for up to 64K bytes of EPROM (any combination of 2716, 2532, or 2564s in pairs), seven prioritized-vectored interrupts (including one non-maskable interrupt), and a 16MHz crystal controlled clock (8MHz processor clock). Other features include two RS232C serial ports, two programmable 16-bit parallel ports, a crystal controlled baud rate generator with 16 standard rates (50 to 19.2K baud), one triple 16-bit programmable timer/counter, and user programmable memory mapping PROMs. Prices range from $1,495 (32K RAM) to $1,995 (128K RAM). Omnibyte Corp., 245 W. Roosevelt Rd., W. Chicago, IL 60185, (312) 231-6880.

CIRCLE INQUIRY NO. 276

TERMS of SALE: Cash, checks, credit cards, or Purchase Orders from qualified firms and institutions. **Minimum Order $15.00.** California residents add 6% tax. Minimum shipping & handling charge $3.00. **Pricing & availability subject to change without notice.**

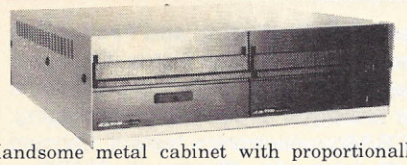
JADE
Computer Products

CIRCLE INQUIRY NO. 111

4901 West Rosecrans Ave., Hawthorne, Ca 90250

Place Orders Toll Free
Continental U.S.
800-421-5500
Inside California
800-262-1710
For Technical Inquires, or Customer Service call:
213-973-7707

Disk Drives



Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

END-000420 *Bare cabinet* **$59.95**
END-000421 *Cabinet kit* **$225.00**
END-000431 *A & T* **$359.95**

8" Disk Drive Subsystems
Single Sided, Double Density

END-000423 *Kit w/2 FD100-8Ds* . **$924.95**
END-000424 *A & T w/2 FD100-8Ds* **$1124.95**
END-000433 *Kit w/2 SA-801Rs* ... **$999.95**
END-000434 *A & T w/2 SA-801Rs* **$1195.00**

8" Disk Drive Subsystems
Double Sided, Double Density

END-000426 *Kit w/2 DT-8s* **$1224.95**
END-000427 *A & T w/2 DT-8s* ... **$1424.95**
END-000436 *Kit w/2 SA-851Rs* .. **$1495.00**
END-000437 *A & T w/2 SA-851Rs* **$1695.00**

QUME DT-8

8" Double-Sided, Double-Density Disk Drive

1 Drive ... $524.95 each
2 Drives . $499.95 each
10 Drives $479.95 each

Jade Part Number MSF-750080

SIEMENS 8"

8" Single-Sided, Double-Density Disk Drive

1 Drive ... $384.95 each
2 Drives . $349.95 each
10 Drives $324.95 each

Jade Part Number MSF-201120

Shugart 801R

8" Single-Sided, Double-Density Disk Drive

1 Drive ... $394.95 each
2 Drives . $389.95 each

Jade Part Number MSF-10801R

MPI B-51

5¼" Single-Sided, Double-Density Disk Drive

1 Drive ... $234.95 each
2 Drives . $224.95 each
10 Drives $219.95 each

Jade Part Number MSM-155100

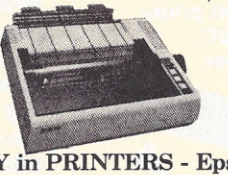
END-000213 *Case & power supply* **$74.95**

Printers

Dual-Mode 200 - Malibu

200 CPS/9 x 9 matrix or 70 CPS/19 x 18 matrix for letter quality, stores up to 12 different fonts, hi-res dot graphics, single sheet and tractor feed, RS-232C and parallel interfaces

PRM-35200 *Dual-Mode 200* **$2695.00**



BEST BUY in PRINTERS - Epson

MX-70 *132 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*
PRM-27070 *List $459* **$399.95**

MX-80 *132 column, 80 CPS, bi-directional/logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*
PRM-27080 *List $645* **$474.95**

MX-80FT *same as MX-80 with friction feed*
PRM-27082 *List $745* **$574.95**

MX-100 *233 column, correspondence quality, ultra-high resolution graphics, up to 15" paper, friction feed & removable/adjustable tractor feed, 18 x18 dot matrix, 80 CPS, programmable forms handling*
PRM-27100 *List $945* **$795.00**

PRA-27084 *Serial interface* **$69.95**
PRA-27088 *Serial intf & 2K buffer* .. **$144.95**
PRA-27081 *Apple card* **$74.95**
PRA-27082 *Apple cable* **$22.95**
PRA-27086 *IEEE 488 card* **$52.95**
PRA-27087 *TRS-80 cable* **$32.95**
PRA-27085 *Graftrax II* **$95.00**
PRA-27083 *Extra ribbon* **$14.95**

Intersell
Sellum I

NEC Spinwriter w/ Intelligent Controller

Standard serial, Centronics parallel, and current loop interfaces • Selectable baud rates 50 to 19,200 • Automatic bidirectional printing • Logic seeking • 650 character buffer with optional 16K buffer • 55 characters per second print speed • Comes with vertical forms tractor, ribbon, thimble and cable • Diablo compatible software • Available with or without optional front panel

PRD-55511 *1K no front panel* **$2795.00**
PRD-55512 *16K no front panel* .. **$2895.00**
PRD-55515 *1K w/front panel* **$2995.00**
PRD-55516 *16K w/front panel* ... **$3095.00**

Intersell NEC 3500Q

Intersell has announced that, available in September, they will offer a version of the new NEC Model 3500Q Spinwriter (30 cps) that will bring to the customer the same standard features as the Sellum I (except the tractor assembly which is optional on the 3500Q) but incorporating the added features of the NEC Model 3500Q

PRD-55351 *3500Q 1K* **$1995.0C**
PRD-55352 *3500Q 16K* **$2095.00**
PRA-55100 *Deluxe tractor option* .. **$300.00**

-For Free Catalog-
Just Circle Our Reader Service Number.

Accessories for Apple

Apple-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer/auto-dial, auxiliary 3-wire RS232C serial port for printer.

IOM-5232A *Save $50.00!!!* **$325.00**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A *A & T* **$199.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A *A & T* **$499.95**

8" DRIVES for APPLE

Controller, DOS, two 8" double densisty drives, cabinet, power supply, & cables

Special Package Price *Kit* **$1399.95**

Z-80* CARD for APPLE

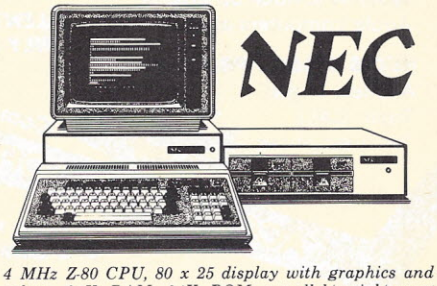
Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP/M 2.2, & BASIC-80*

CPX-30800A *A & T* **$299.95**

APPLE CLOCK - Cal Comp Sys

Real time clock w/battery back-up

IOK-2030A *A & T* **$109.95**



4 MHz Z-80 CPU, 80 x 25 display with graphics and 8 colors, 32K RAM, 24K ROM, parallel/serial/cassette interfaces, upper/lower case, numeric keypad, 10 special function keys, uses CP/M 2.2.

NEC-8001A *32K CPU/keyboard* .. **$1095.00**
NEC-8012A *I/O with 32K RAM* ... **$695.00**
NEC-8031A *Dual disk unit* **$1095.00**
VDM-651200 *12" green CRT* **$269.95**
NEC-1202D *Hi-res RGB color CRT* **$1045.00**
VDC-651212 *12" color monitor* **$479.95**
NEC-9010S *CP/M 2.2 for NEC* **$150.00**
NEC-90005 *Gen. accting softwr* ... **$375.00**

Novation Cat Modem

IOM-5200A *List price $189.95* **$125.00**

D-CAT *300 baud, direct connect modem*
IOM-5201A *Special sale price* **$169.95**

AUTO-CAT *Auto answer/origiate, direct connect*
IOM-5230A *Special sale price* **$239.95**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A *Smartmodem* **$269.95**

CALENDAR

Nov 2-4 Mini/Micro Conference and Exposition, Convention Center, Anaheim, CA, equipment exhibitions and discussions on large and small computer systems. Mini/Micro Exposition, 32302 Camino Capistrano, Suite 202, San Juan Capistrano, CA 92675.

Nov 3-5 National Electronic Packaging and Production Conference, San Mateo Fairgrounds, San Mateo, CA, latest developments in the machinery, equipment, tools, hardware and supplies utilized for prototype circuit design/packaging, PCB production, and PCB/Microelectronics testers. Cahners Exposition Group, 222 W. Adams St., Chicago, IL 60606.

Nov 5 Invitational Computer Conference, Marriott Hotel, Amsterdam, The Netherlands, display of products including printer/plotters, floppy disks, Winchesters and other disk drives, streaming and conventional tape drives, interface and controller products, power supplies, terminals, minicomputers and microcomputers. Also held Nov 12 at Hotel Sofitel, Severes, Paris, France and Nov 17 at the Hotel Executive, Milan, Italy. B.J. Johnson & Assoc., 2503 Eastbluff Dr., Suite 203, Newport Beach, CA 92660.

Nov 8-10 American Computer Chess Championship, Bonaventure Hotel, Los Angeles, CA, annual championship tournament will include two four-round sessions. Assoc. for Computing Machinery, 1133 Ave. of the Americas, New York, NY 10036.

Nov 8-10 Comp-U-Con Computer Show, Shrine Civic Center, Los Angeles, CA, displays of equipment geared towards the small businessman and the home user/hobbyist. Also held at the Cow Palace, San Francisco, CA, Nov 19-21 and at the Denver Convention Complex, Denver, CO, Dec 3-5. Jim Everett, 314 W. 24 Highway, Independence, MO 84050, (816) 836-1000.

Nov 9-10 Software Fair, Stouffer's Riverfront Towers, St. Louis, MO, exhibitions by software suppliers with systems in current use by wholesalers and distributors of hard goods sold to commercial and industrial users. National Industrial Distributors Assoc., 1900 Arch St., Philadelphia, PA 19103.

Nov 10-12 Midcom 81, O'Hare Expo Center and Hyatt Regency Hotel, Rosemont, IL, electronics exposition and convention. Midcon, 999 N. Sepulveda Blvd., El Segundo, CA 90245.

Nov 12-14 Accounting and Information Systems Expo 81, MGM Grand Hotel, Reno, NV, seminars and demonstrations on the information systems field. Div. of Continuing Education, University of Nevada-Reno, College Inn, Reno, NV 89557.

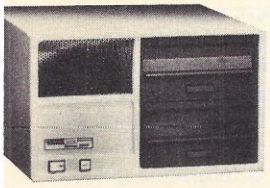
Nov 21-22 Games Faire and AppleFest, Convention Center, San Jose, CA, focusing on electronic products for entertainment and Apple computer-related products. Computer Faire, 333 Swett Rd., Woodside, CA 94062.

Dec 1-3 Legal Info Conference, Shoreham Hotel, Washington, D.C., seminars to aid lawyers in selecting hardware and software that will be beneficial in their practice. Legal Info, 1730 N. Lynn St., Suite 400, Arlington, VA 22209.

BETA COMPUTER DEVICES

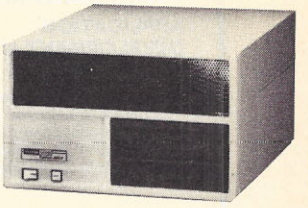
AVAILABLE NOW ... SYSTEM 2800 FROM SYSTEMS GROUP

FEATURES

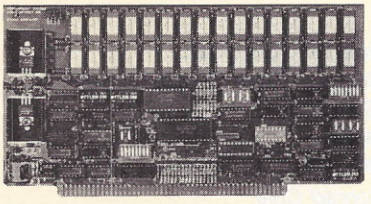


- IEEE S-100 Bus Compatible Systems, Z80A Based
- Two 8-Inch Drives: Single or Double Sided, Double Density Floppy Disk Drives or 10MB Winchester Hard Disk Drive
- 20MB Winchester and Tape Backup
- 8-Slot Shielded and Terminated Motherboard
- System Software Selection includes CP/M*, MP/M* or OASIS**
- Single-User or Multi-User Systems, Expandable to 6 Users
- Table Top or Rack Mountable
- Two Switched AC Outlets on Rear Panel
- One Year Warranty on Entire System

2812 CP/M, 2 Single Sided Floppies.....$3775.00
2814 CP/M, 2 Double Sided Floppies..... 4425.00
2819 CP/M, 1 10 MB Winchester & 1 Double Sided Floppy..... 6675.00
2824 MP/M, 2 Double Sided Floppies.... 5235.00
2829 MP/M, 1 10 MB Winchester & 1 Doubled Sided Floppy.... 7500.00



S-100 PRODUCTS



QUALITY RAM FROM SYSTEMS GROUP

- Z-80 4MHZ operation with no wait states
- IEEE compatible timing - 200 NS 4116's
- Factory assembled, tested & burned in

DMB6400 64K (Bank Select, shown).....$749.00
DM6400 64K 545.00
DM4800 48K..... 520.00
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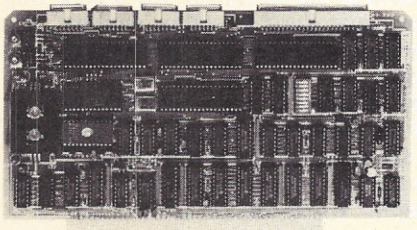

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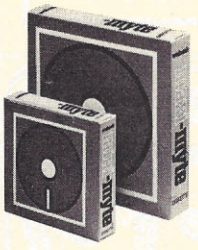

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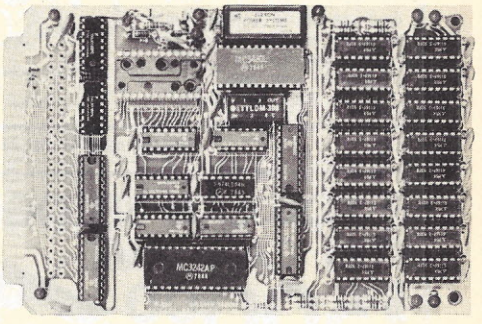

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BOOK REVIEWS

Computer Language Reference Guide
by H. Helms, Jr.
Howard W. Sams, Indianapolis, IN

Reviewed by David Marca

This small language reference book strives to cover the most common and general aspects of seven different computer languages. The primary goal of giving the reader a general familiarity with each language is met. There's good content in this package, and it also contains a keyboard dictionary.

The book presents most of the widely-known computer languages: Algol, Basic, Cobol, Fortran, Lisp, Pascal and PL/I. The exposition of each language is as consistent as it could be, due to the wide differences in philosophy. The book was not designed to be a tutorial—it is a reference guide.

For those who need information to understand a program presented in a magazine article, for instance, this book is a useful tool. It is ideal for the novice who does not wish to spend large amounts of time learning many other languages, but still has a frequent need to read different kinds of software.

109 pages $6.95

The Microelectronics Revolution: A Complete Guide to the New Technology and its Impact on Society
Edited by Tom Forrester
MIT Press, Cambridge, MA

Reviewed by Bernard Conrad Cole

If you've been giving some serious thought to the overall impact of microelectronics and microprocessors on society, this is the book to read.

The aim of this anthology is to collect the most significant articles published in the popular and business press over the last five years. It is to Forrester's credit that the book comes close to staying on target.

The book is organized into three sections; the first dealing with the technical aspects of the revolution, the second with its economic impact in industry and the office (and the consequences for employment) and the third with development of the information society.

Key articles include those by industry leaders such as Robert Noyce of Intel and business journalists such as Gene Bylinsky, as well as social theorists and futurists such as Daniel Bell. Especially useful are the guides to further reading at the end of each chapter, which include not only listings of other key papers, but comments by the editor summarizing each article and its significance.

589 pages $12.50

Without Me You're Nothing: The Essential Guide to Home Computers
by Frank Herbert, with Max Barnard
Simon and Schuster, New York, NY

The man who brought mysticism back to science fiction with his Dune novels has gone a long way toward removing mysticism from computers—as well as books about computers.

This is a readable and enjoyable primer for computer beginners. While its content is neither more nor less complete than other similar guides, it is certainly one of the most imaginative and well written examples.

The most interesting aspect of the book is a new approach to programming based on a new kind of flow chart that the authors call PROGRAMAP. According to the authors, the object is to provide a smooth transition from outline to program. As a top-down approach to programming, it attempts

to get the user to visualize the problem first, write it down in the graphic symbols of PROGRAMAP and then translate it to the specifics of programming languages. It is a very interesting concept and worth another book. **—BCC**

304 pages $14.95

Techniques of Basic
by John P. Grillo and J.D. Robertson
Wm. C. Brown Co., Dubuque, IA

Reviewed by Rocky Smolin

This book is for those who have overcome their fear of programming, have become familiar with the rudiments of Basic, and require an easy-to-use guide to the language. Although less suited for a step-by-step hand-holding type of teaching manual than some other books on the market, it is unsurpassed as a reference manual.

The first few chapters proceed as one would expect—decision and branching statements, functions (DIM, STRINGS, etc.), input and output commands, and a discussion of variable types. Included is an extensive presentation of the graphic capabilities of Basic.

The next section explores the world of the disk and those extensions of Basic one finds only under versions of disk Basic (MID$, TIME$, DEFUSR, and the like). Both sequential and direct access file processing methods are presented in detail and should unravel many of the mysteries of disk Basic programming.

In addition to these rather standard subjects, the authors have included several unique but valuable topics. Chief among these are conversational programming techniques, which make programs easier, friendlier, and more enjoyable to use. The chapter on structured programming should probably have been placed at the beginning of the book to emphasize the importance of these techniques in writing better, more maintainable programs in less time. A real surprise was the chapter on documentation—a topic of critical importance almost universally ignored by computer books.

The book is liberally illustrated, uses a large print format, and has a comprehensible style. It is highly recommended.

256 pages $18.95

Microsoft Fortran
by Paul M. Chirilian
Dilithium Press, Beaverton, OR

This comprehensive guide to Microsoft Fortran is valuable as a self teaching text, as well as a desk reference. It is intended for readers with no experience in Fortran. In addition to a thorough examination of the language, the book employs and teaches the techniques of structured programming. The novice not only learns Fortran, but also gets the benefit of some valuable programming disciplines.

By the time the reader has finished the first chapter, he will be able to write simple programs in Fortran. The rest of the book proceeds in a logical manner, covering arithmetic operations, input and output statements, control statements (IF, GOTO, DO, etc.), looping operations, arrays and subscripted variables, and subprograms.

No Fortran subject is left unexposed by the book. Variable types, logical operations, string manipulation, and random, direct, and sequential file access techniques are all presented. The style is refreshingly clear and concise—comprehensible by those with little experience, but not simplified to the point where essential information is left out. Those requiring either an introductory Fortran text on a comprehensive reference book will be highly pleased with this book. **—RS**

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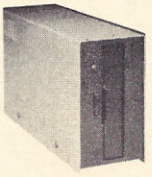

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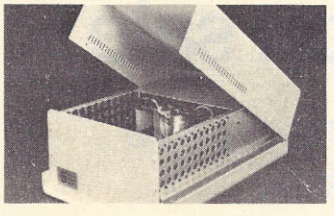

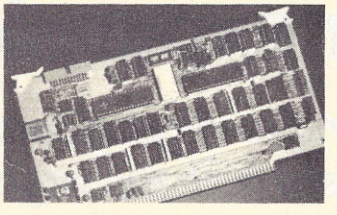

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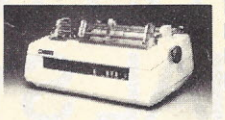

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CIRCLE INQUIRY NO. 201

Stock market data is provided in 32-page catalog. It contains information about time series analysis, stock and commodity market software, and stock and commodity market data bases. The software is available for the Hewlett Packard 9845 desktop computer and the HP-85 personal computer. Cyber Engineering Corp., Box 4143, Huntsville, AL 35802.

CIRCLE INQUIRY NO. 202

Computer buyer's guide. Sample issue of the Association of Computer Users' bimonthly publication, *Interactive Computing,* includes the article "Ten Pitfalls to Avoid in Buying a Small Computer System." ACU, Box 9003, Boulder, CO 80301.

CIRCLE INQUIRY NO. 203

Design handbook, the SI-100, offers the design engineer complete technical information on liquid crystal displays. Subjects discussed include: principles of operation, driving techniques, surface treatments, sealing, cost and reliability. The manual also includes detailed information on multiplex drive techniques. Field reliability data and a seven-year life data are also included. Seiko Instruments, 2990 W. Lomita Blvd., Torrance, CA 90505.

CIRCLE INQUIRY NO. 204

Dot-matrix print mechanisms, series Eaton M-4, are described in an illustrated six-page brochure. The publication stresses the high quality product design and componentry used in the print mechanisms that make them reliable at modest cost. Complete printhead specifications are given for short, medium and long-stroke models. Detailed engineering drawings and illustrations are provided for split paper feed printers, documents printers and single roll printers. Additional information is given about print speeds, characters per line, print area, printhead sweep, pulse width and current requirements, duty cycles, input voltages and operating temperatures. Eaton Corp., 100 Erieview Plaza, Cleveland, OH 44114.

CIRCLE INQUIRY NO. 205

Storage control unit, Memorex 3676, is described in brochure. This literature describes disc subsystem configuration flexibility, downward compatibility support, exclusive features, central processing unit attachment, physical characteristics, power requirements and operating environment considerations. Ed Vopat, Memorex Corp., MS 12-16, San Tomas at Central Expressway, Santa Clara, CA 95052.

CIRCLE INQUIRY NO. 206

Game Corner

Continued from page 24

inconsistency like this. From a teacher's standpoint, I see Robotwar as a dandy teaching aid to help students learn programming. The language doesn't have a lot of commands, does only simple things, and has a really good incentive attached to it. The student who acquires programming proficiency won't get clobbered as easily. It is also sufficiently similar to Basic and Fortran that it can serve as a springboard to higher languages when the student is ready for them.

Of course, for the person who is already a proficient programmer, the language won't be much to master; it will be the strategy of the programming that takes the real concentration. We see Robotwar becoming the first of a whole sub-genre of computer games for programmers. It's like being able to play chess, and create new pieces with new moves. In a lot of ways, it is the next step up from chess.

Chess players have traditionally carried on games of correspondence chess when unable to meet in person. Lately chess played by telecommunication, rather than postal communication, has begun. Played on a telephone game network like GameMaster, this game would allow each combatant to engage robots against an opponent on a neutral playing field where neither combatant would have access to the other's proprietary code. All that would be needed is a modem-driver addition to the program, so that it could be used on the telecom link.

We received Robotwar expecting just another "zap the klingons" type of combat game, and were surprised to find a wargame that should appeal to the bloodthirstiest Star Wars freak—and at the same time—a programming language, a word processor, a training manual, and an entire realm of virtual machines whose moves and actions YOU define, but don't control. It's worth many times the listed price. □

GAME CORNER

Listing

```
;  ROBOT "HECTOR II"
;  DESIGNED BY LARRY FARRELL
;  AND MARK HOUGAARD
  360 TO RANDOM              random angle between 0 and 360
  RANDOM TO AIM              aim cannon at random angle
  DAMAGE TO K                "K" contains % of damage
SCAN
  IF RADAR < 0 GOTO FIRE     radar contact with another robot
  AIM - 13 TO AIM TO RADAR   shift radar beacon and aim 13
  IF RADAR < 0 GOTO FIRE     contact now? fire!
  IF K-DAMAGE > 10 GOTO MOVE    damage > 10%? move!
  IF RANDOM > 200 GOTO MOVE   move about half the time anyway
  GOTO SCAN                  continue scanning
MOVE
  DAMAGE TO K            update K (damage currently recorded)
  RANDOM TO H            horiz.-move distance
  RANDOM TO V            vert.-move distance
MOVEX                 horizontal move
  H-X*100 TO SPEEDX      speed depends on desired position
  GOSUB MSCAN            stop if within 100 horizontal
  IF H-X>100 GOTO MOVEX     units of where
  IF H-X<-100 GOTO MOVEX      you want to go
  GOSUB STOP
MOVEY                 vertical move
  V-Y*100 TO SPEEDY      speed depends on desired position
  GOSUB MSCAN            stop if within 100 vertical
  IF V-Y>100 GOTO MOVEY    units of where
  IF V-Y<-100 GOTO MOVEY      you want to go
  GOSUB STOP
  GOTO SCAN
STOP
  0 TO SPEEDX TO SPEEDY    stop motion
  ENDSUB
MSCAN
  AIM TO RADAR               keep cannon locked to radar beam
  IF RADAR < 0 GOTO MSCAN1     contact? mscan1 stops movement
  AIM-13 TO AIM TO RADAR     backup aim if no contact
  IF RADAR < 0 GOTO MSCAN1     contact? mscan1 stops movement
  ENDSUB
MSCAN1
  0 TO SPEEDX TO SPEEDY         stop motion
FOUND
  IF K-DAMAGE > 10 GOTO MOVE    hit? move!
  AIM TO RADAR                  keep cannon locked to radar
  IF RADAR > 0 GOTO FIND        search routine
FIRE
  13 TO A                   initializes (FIND) search routine
  0-RADAR TO SHOT           fire
  0-RADAR TO SHOT           twice
  GOTO FOUND
FIND                   scans back and forth in increasing sweeps
  IF K-DAMAGE > 10 GOTO MOVE    hit? move!
  C+1 TO C                      count--"FOR loop"
  AIM + A TO AIM TO RADAR       move cannon and radar
  IF RADAR < 0 GOTO FIRE        contact? fire!
  A+13 TO A                     wider scan
  AIM-A TO AIM TO RADAR         move cannon and radar
  IF RADAR < 0 GOTO FIRE        contact? fire!
  A+13 TO A                     wider scan
  IF C < 3 GOTO FIND            continue 3 times
  0 TO C                        reset "FOR loop" counter
  GOTO MOVE                     no contact--target lost
```

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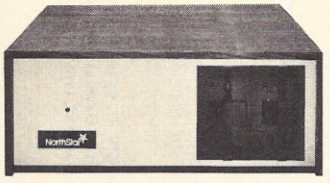

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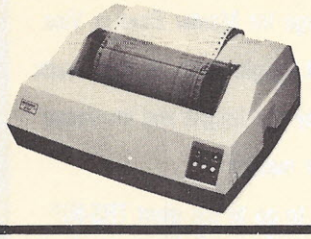

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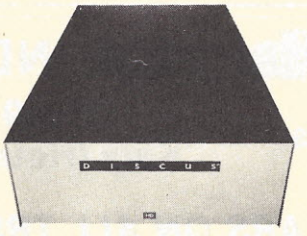

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The Inventor's Sketchpad

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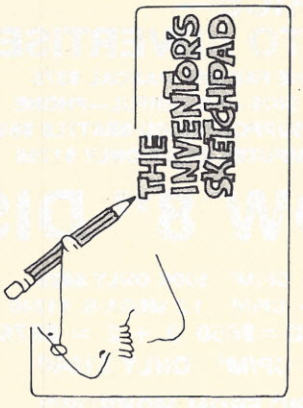

Listing

```
#include "C.plus"
global_data_definitions
  ---
  ---
  DEFINITIONS OF ALL GLOBAL DATA
  ---
  ---
end_global_data_definitions
the_following_defines_the FUNCTION_NAME(FUNCTION_ARGUMENTS) function
  data_definitions
    references_to_global_variables
      ---
      ---
      GLOBAL VARIABLES REFERENCES
      ---
      ---
    end_references_to_global_variables
    local_data_definitions
      ---
      ---
      DEFINITIONS OF LOCAL DATA
      ---
      ---
    end_local_data_definitions
  end_data_definitions
  executeable_section
    ---
    ---
    EXECUTEABLE STATEMENTS FOR THE NAMED FUNCTION
    ---
    ---
  end_executeable_section
end_function_definition

Note the use of the ' #include "C.plus" ' statement at the beginning
of the program. This invokes all of the C.plus conventions. Compiling
of a C.plus program is identical to compiling of a regular C program.
```

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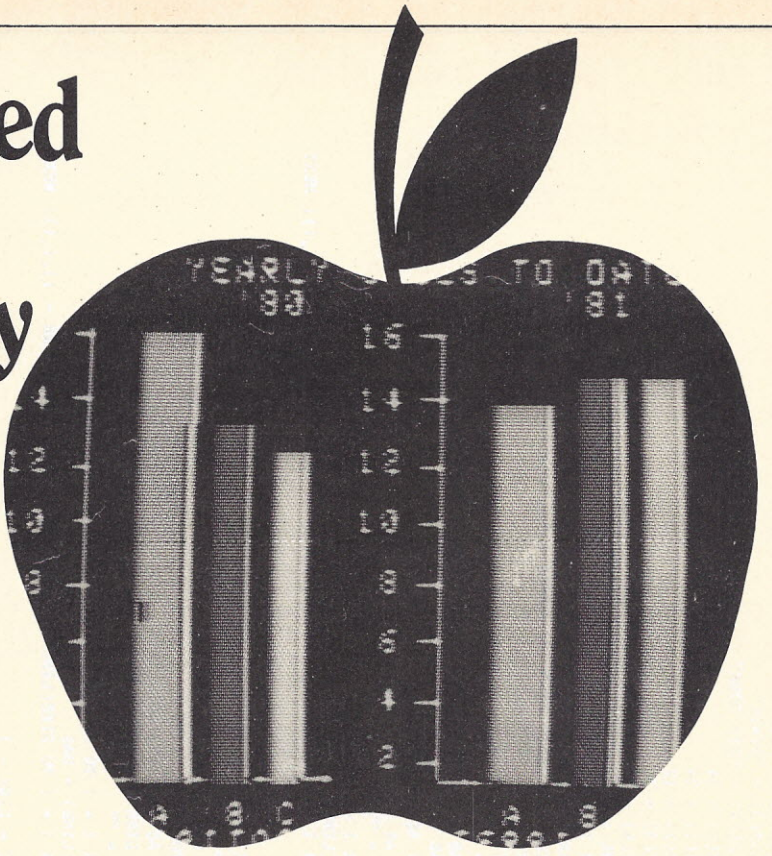

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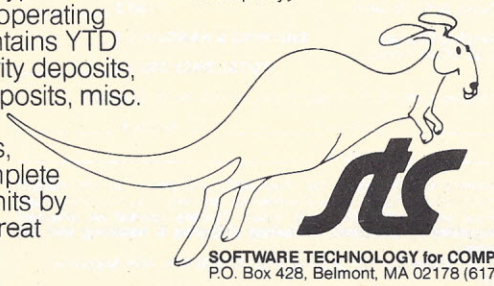

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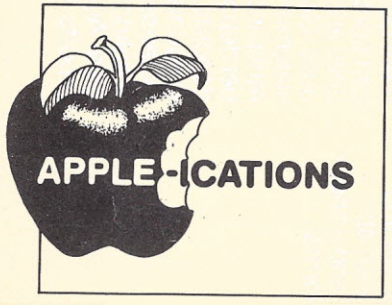
Apple-ications *Continued from page 43*



Listing 2

```
1000 UL$ =  CHR$ (95)
1010  FOR I = 1 TO 5
1020 UL$ = UL$ + UL$
1030  NEXT
1040  DIM FIELD$(5),SIZE(5),DA$(5),SA$(25)
1050 CR$ =  CHR$ (13):RA$ =  CHR$ (21):LA$ =  CHR$ (8):ES$ =  CHR$ (27)
1060 FIELD$(0) = "NAME"
1070 FIELD$(1) = "ADDRESS"
1080 FIELD$(2) = "CITY"
1090 FIELD$(3) = "STATE"
1100 FIELD$(4) = "ZIP CODE"
1110 SIZE(0) = 24
1120 SIZE(1) = 24
1130 SIZE(2) = 12
1140 SIZE(3) = 2
1150 SIZE(4) = 9
1200  HOME : PRINT "     PLEASE ENTER NAME AND ADDRESS"
1210  FOR I = 0 TO 4
1220  VTAB 5 + I * 2
1230  PRINT FIELD$(I) TAB( 12) LEFT$ (UL$,SIZE(I))
1240  NEXT
1250 LINE = 0
1260 HP = 1
1300  VTAB 5 + LINE * 2
1310  HTAB HP + 11
1320  GET A$: PRINT ES$;
1330  IF A$ <  > CR$ GOTO 1450
1340 DA$ = ""
1350  FOR I = 1 TO SIZE(LINE):DA$ = DA$ + SA$(I): NEXT
1360 DA$(LINE) = DA$
1380  FOR I = 1 TO SIZE(LINE + 1):SA$(I) =  MID$ (DA$(LINE + 1),I,1): NEXT


1410 LINE = LINE + 1
1420 HP = 1
1430  IF LINE < 5 GOTO 1300
1440  GOTO 2000
1450  IF A$ <  > ES$ GOTO 1570
1460  IF LINE = 0 GOTO 1300
1470 DA$ = ""
1480  FOR I = 1 TO SIZE(LINE):DA$ = DA$ + SA$(I): NEXT
1490 DA$(LINE) = DA$
1510  FOR I = 1 TO SIZE(LINE - 1):SA$(I) =  MID$ (DA$(LINE - 1),I,1): NEXT

1540 LINE = LINE - 1
1550 HP = 1
1560  GOTO 1300
1570  IF A$ <  > LA$ GOTO 1610
1580  IF HP = 1 GOTO 1300
1590 HP = HP - 1
1600  GOTO 1300
1610  IF A$ <  > RA$ GOTO 1650
1620  IF HP >  = SIZE(LINE) GOTO 1300
1630 HP = HP + 1
1640  GOTO 1300
1650  IF A$ < " " OR A$ > "^" OR SIZE(LINE) < HP GOTO 1300
1660  PRINT A$;
1670 SA$(HP) = A$
1680 HP = HP + 1
1690  GOTO 1300
2000  PRINT : PRINT : PRINT
2005  PRINT "     YOUR MAILING LABEL IS:"
2007  PRINT : PRINT
2010  PRINT DA$(0)
2020  PRINT DA$(1)
2030  PRINT DA$(2)" "DA$(3)"  "DA$(4)

]
```

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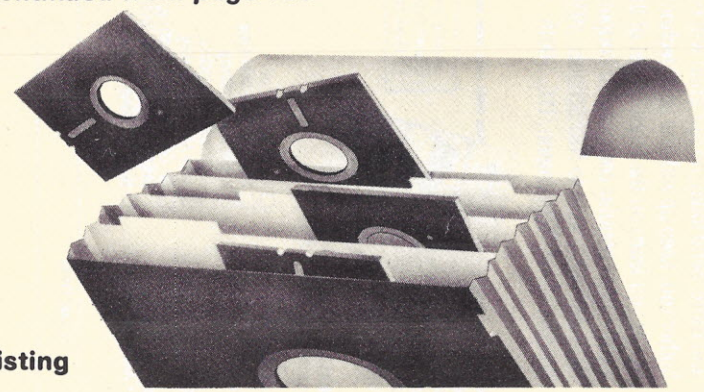
A Master Disk Directory

Continued from page 106



Listing

A master disk directory

The completed program is:

```
/* Small C Program to Maintain the Master Directory file */

#include "C.LIB"

#define tfcb 92
#define tbuff 128
#define FF 12       /* character to clear screen */
#define r0 tfcb+33
#define r1 r0+1
#define r2 r0+2

int  size, fract, *numptr, blkmsk, nblkmsk, perblk, denmsk,
     used, left, nent, i, j, k, eof, rcnt, ncnt, datcnt,
     more, temp, volnent, option, ndels, nadds, dcnt,
     maxent,        /* total allowed in adds */
     anent,         /* total number of entries in adds */
     addvol[100];   /* pointer to beginning index for adds */

char *dir, *mem,
     *fcbdir, *fcbbak, *fcbdol, *fcbdat,
     volid[3],
     pmask[20],     /* mask to match for reading */
     rfcb[36],      /* input fcb */
     rdbuff[128],   /* input read buffer */
     nfcb[36],      /* output fcb */
     nbuff[128],    /* output write buffer */
     datfcb[36],    /* .DAT output fcb */
     datbuff[128],  /* .DAT output buffer */
     newent[16],
     oldent[3],     /* used to seperate volids */
     vol[2112],     /* holding area for one volume */
     dels[100],     /* volids of deletes (<33) */
     *nextaddr,     /* points to next avail spot in adds */
     adds[1];       /* must be last declaration before main */

main()
    {verify();
          getvol();
          if((pause())==3)break;
         }
     closemst();
     return;
    }

pause()
    {char ch;
     prtstr("...Press any key to continue ");
     ch=inch();
     crlf();
     return (ch);
    }

prtvol()
    {
     int i,j;
     crlf();prtstr(" Volume ID: ");
     i=0;while(i<3)outch(vol[16+(i++)]);
     i=0;while((++i)<=volnent)
         {
          j=(i<<4)+3;
          if((i%4)==1)crlf();
          k=0;while(k<8)outch(vol[j+(k++)]);
          outch('.');while(k<11)outch(vol[j+(k++)]);
          numptr=vol+j+11;
          prtdec(*numptr);
          prtstr("   ");
         }
     crlf();
    }

opt2()
    {
     if((anent>maxent)|(nadds>49))
         {
          prtstr("No room to add more - must update");
          pause();return;
         }
     prtstr("Enter diskette to be added (changed) into drive B");
     crlf();pause();
     dir=(nextaddr)-16;
     used=nent=0;
     setup2();
     findfiles();
     usedleft();
     bdos(0,13); /* reset to drive A */
     return;
    }


setup2()
    {
     char *mem,*ftr,ch,str[10]; int i,j,k,numblks;
     crlf();bdos(1,14); /* select drive B */
     mem=tfcb;
     erase(tfcb,36);
     ftr=" [VOLID] ";
     i=1;while(i<9)mem[i]=ftr[i++];
     while(i<12)mem[i++]='?';
     k=(bdos(tfcb,17)&255);

     if(k==255)
         {
          prtstr("No [VOLID] present - ");
```

```
     while(more)menu();
     return;
    }

verify()
    {if(!(bdos(0,12)&255))
        {
         prtstr("This program requires CPM 2.0 or later");
         bdos(0,0);
        }
     if((bdos(0,25)&255))
        {
         prtstr("Master Disk Directory Utility Program must be on drive A")
         bdos(0,0);
        }

         maxent=(((*(6))>>4)&4095)-((adds>>4)&4095)-125;
         more=1; nextaddr=adds; anent=nadds=ndels=0;
         fcbdir="[MASTER]DIR";
         fcbbak="[MASTER]BAK";
         fcbdol="[MASTER]$$$";
         fcbdat="[MASTER]DAT";
        }

    menu()
        {option=0;
         while((option<'1')|(option>'9'))dispmenu();
         crlf();crlf();
         if(option=='1')optl();
         else if(option=='2')opt2();        /* The case statement */
         else if(option=='3')opt3();        /* would be nice here */
         else if(option=='4')opt4();
         else if(option=='5')opt5();
         else if(option=='6')opt6();
         else if(option=='7')opt7();
         else if(option=='8')opt8();
         else if(option=='9')more=0;
         return;
        }

    dispmenu()
        {
         outch(FF);     /* clear screen for ADDS  */
         prtstr("Master Disk Directory Utility Program");
         crlf();crlf();
         prtstr("       1    List Master Directory File");crlf();
         prtstr("       2    Enter Add (Change) (room for ");
         prtdec(maxent-anent);prtstr(" more entries)");crlf();
         prtstr("       3    Enter Delete       (room for ");
         prtdec(32-ndels);prtstr(" more volids)");crlf();
         prtstr("       4    Update the Master Directory File");crlf();
         prtstr("       5    Display Deletes List");crlf();
         prtstr("       6    Display Adds (Changes) List");crlf();
         prtstr("       7    Display Adds (Changes) Entries");crlf();
         prtstr("       8    Extract from Master Directory File");crlf();
         prtstr("       9    Exit to CP/M");crlf();crlf();crlf();
         prtstr("  Enter Option Number ");
         option=inch();
        }

    optl()
        {openmst();
         if(!volnent){prtnone();pause();}
         while(volnent)
             {prtvol();
              str[0]=8;str[1]=i=0;
              while(!i)
                  {
                   prtstr("Enter 3 digit volume ID ");
                   bdos(str,10);i=str[1];
                  }
              while(i<3)str[2+(i++)]=' ';
              erase(mem,36);
              i=1;while(i<9)mem[i]=ftr[i++];
              i=0;while(i<3)mem[9+i]=str[2+(i++)];
              bdos(tfcb,22); /* make volid entry */
              ftr=str+2;
             }
            else ftr=tbuff+(k<<5)+9;
           i=0;while(i<3)volid[i]=ftr[i++];
           erase(mem,36);
           i=1;while(i<13)mem[i++]='?';
               /* determine density, capacity from DPB header */
           mem=bdos(0,31);          /* address of DPB header */
           blkmsk=mem[3]&255;       /* block mask */
           nblkmsk=((~blkmsk)&255); /* complement of block mask */
           denmsk=(blkmsk>>3);      /* density mask */
           perblk=((blkmsk+1)>>3);  /* #k per block */
           numptr=mem+5;
           numblks=(*numptr)+1;     /*blks per disk*/
           left=                    /* #k available = */
                (numblks*perblk)    /* #k per disk */
               - (((mem[7]&255)+1)>>5); /* less #k in directory */
          }

    findfiles()
        {int i,j,k; char *mem;
         k=(bdos(tfcb,17)&255);
         while(k!=255)
             {enter(tbuff+(k*32));
              k=(bdos(tfcb,18)&255);
             }
        }

    enter(fcb) char fcb[];
        {int i,j,m,s;
         i=s=1;j=nent;
         while(i<=j)
             {m=(i+j)>>1;
              if(!(s=vmatch(fcb,dir+(m<<4)+2)))break;
              if(s<0)j=m-1; else i=m+1;
             }
         if(!s)
             {j=m<<4;
              numptr=dir+j+14;
              i=*numptr;
             }

           else
             {j=((++nent)<<4);anent++;
              while((j>16)&(vmatch(dir+j-14,fcb)>0))
                  {i=0;while(i<16)dir[j+i]=dir[j+(i++)-16];j=j-16;}
              i=0;while(i<3)dir[j+i]=volid[i++];
              while(i<14)dir[j+i]=fcb[(i++)-2];
              while(i<16)dir[j+(i++)]=0;
              i=0;
             }
         i=((fcb[12]&denmsk)<<4)+(((blkmsk+fcb[15])&nblkmsk)>>3)+i;
         numptr=dir+j+14;
         *numptr=i;
        }
```

```
vmatch(a,b) char a[],b[];
    {int i;
     i=0;while((++i)<12)
         {if(a[i]>b[i])return 1;
          if(a[i]<b[i])return -1;
         }
     return 0;
    }

usedleft()
    {int i,j,k,l; char *ptr;
     i=l=0;while(i<nent)
               {j=(++i)<<4;
                ++l;numptr=dir+j+14;
                size=*numptr;
                used=used+size;
               }

     j=j+16;
     i=0;while(i<3)dir[j+i]=dir[j+i+16]=dir[j+i+32]=volid[i++];
     ptr="[files]      ";
     i=0;while(i<11)dir[j+i+3]=ptr[i++];
     numptr=dir+j+14; *numptr=l;
     ptr="[used]       ";
     j=j+16;
     i=0;while(i<11)dir[j+i+3]=ptr[i++];
     numptr=dir+j+14; *numptr=used;
     left=left-used;
     ptr="[free]       ";
     j=j+16;
     i=0;while(i<11)dir[j+i+3]=ptr[i++];
     numptr=dir+j+14; *numptr=left;
     anent=anent+3;
     j=j+16;
     temp=nextaddr; nextaddr=dir+j;
     erase(dir+j,16);
     j=(++nadds);
     while((j>1)&(match(addvol[j-1],temp,0,2)>0))
         {addvol[j]=addvol[(j--)-1];}
     addvol[j]=temp;
     return;
    }


opt3()
    {char str[10]; int i,j;
     if(ndels>31)
         {prtstr("Too many deletes - must update");
          pause();return;
         }
     str[0]=8;str[1]=i=0;
     while(!i)
         {prtstr("Enter 3 digit volume ID ");
          bdos(str,10);i=str[1];
         }
     while(i<3)str[2+(i++)]=' ';
     j=(++ndels)+ndels+ndels;
     while((j>3)&(match(dels+j-3,str+2,0,2)>0))
         {i=0;while(i<3)dels[j+i]=dels[j-3+(i++)];
          j=j-3;
         }
     i=0;while(i<3)dels[j+i]=str[2+(i++)];
     return;
    }

opt4()
     crlf();crlf();
     i=1;while(i<=ndels)
              {j=(i<<1)+(i++);
               k=0;while(k<3)outch(dels[j+(k++)]);
               outch(' ');outch(' ');
              }
     if(!ndels)prtnone();
     crlf();crlf();pause();
    }

opt6()
    {int i,j,k; char *ptr;
     crlf();prtstr("Request to add (change) these volid's");
     crlf();crlf();
     i=1;while(i<=nadds)
          {ptr=addvol[i++];
           k=0;while(k<3)outch(ptr[k++]);
           outch(' ');outch(' ');
          }
     if(!nadds)prtnone();
     crlf();crlf();pause();
    }


prtnone() {prtstr(" ***None***");}

opt7()
    {int i,j,k,l; char *ptr;
     prtstr("Entries to be added (changed):");crlf();
     if(!anent){prtnone();pause();return;}
     i=0;while((i++)<nadds)
              {ptr=addvol[i];j=0;
               crlf();prtstr(" Volume ID: ");
               k=0;while(k<3)outch(volid[k]=ptr[j+(k++)]);
               crlf();l=0;
               while(!match(volid,ptr+j,0,2))
                   {if(!((l++)%4))crlf();
                    k=3;while(k<11)outch(ptr[j+(k++)]);
                    outch('.');while(k<14)outch(ptr[j+(k++)]);
                    numptr=ptr+j+14;
                    prtdec(*numptr);
                    prtstr("   ");
                    j=j+16;
                   }
               crlf();
               if((pause())==3)break;
               crlf();
              }
    }

opt8()
    {openmst();
     opendat();
     while(volnent)putdat();
     closedat();
     closemst();
    }

opendat()
    {int i;
     erase(datfcb,36);
     i=0;while(i<11)datfcb[i+1]=fcbdat[i++];
     bdos(datfcb,19); /* delete any old .DAT */
     erase(datfcb,36);
     i=0;while(i<11)datfcb[i+1]=fcbdat[i++];
     if((bdos(datfcb,22)&255)==255) /* try to create .DAT */
```

```
    {if((!ndels)&(!nadds))
        {prtstr("No activity to update");
         crlf();pause();return;
        }
     dcnt=1;
     openmst();opennew();
     updatemst();
     closemst();closenew();
     renames();
     nextaddr=adds;
     anent=nadds=ndels=0;
    }

updatemst()
    {int n,k;
     n=1;while((n<=nadds)|(volnent>0))
         {if(!volnent)putdir((addvol[n++]));
          else if(n>nadds)putvol();
          else if(!(k=match(vol+16,(addvol[n]),0,2)))getvol();
          else if(k<0)putvol();
          else putdir((addvol[n++]));
         }
     return;
    }

putdir(dvol) char *dvol;
    {int i;
     i=0;while(i<3)volid[i]=dvol[i++];
     i=0;while(!match(dvol+i,volid,0,2))
              {dputout(dvol+i);i=i+16;}
    }


dputout(ptr) char *ptr;
    {int i,j;
     if(ncnt>7)wrtnew();
     j=(ncnt++)<<4;
     i=0;while(i<16)nbuff[j+i]=ptr[i++];
    }

wrtnew()
    {int i; char *ptr;
     ptr=tbuff;
     i=0;while(i<128){ptr[i]=nbuff[i];nbuff[i++]=0;}
     if(bdos(nfcb,21))
         {prtstr("***Cannot Write New Master***");
          crlf();pause();return;
         }
     ncnt=0;
    }

putvol()
    {int i; i=0;while((i++)<volnent)vputout(i<<4);
     getvol();
    }

vputout(ptr) int ptr;
    {int i,j;
     if(ncnt>7)wrtnew();
     j=(ncnt++)<<4;
     i=0;while(i<16)nbuff[j+i]=vol[ptr+(i++)];
    }

opt5()
    {int i,j,k;
     crlf();prtstr("Delete requests for these volid's");
         {prtstr("No room for .DAT file");
          crlf();
          bdos(0,0);
         }
      erase(datbuff,128);
      datcnt=0;
     }

putdat()
    {int i,j;
     i=0;while((i++)<volnent)datputout(i<<4);
     getvol();
    }


datputout(ptr) int ptr;
    {int i,j; char str[8];
     i=0;while(i<14)outdatch(vol[ptr+(i++)]);
     numptr=vol+ptr+14;
     todec(*numptr,str);
     i=0;while(i<3)outdatch(str[i++]);
     outdatch(13);outdatch(10);
    }

outdatch(ch) char ch;
    {if(datcnt>127)wrtdat();
     datbuff[datcnt++]=ch;
    }

wrtdat()
    {int i; char *ptr;
     ptr=tbuff;
     i=0;while(i<128){ptr[i]=datbuff[i];datbuff[i++]=26;}
     if(bdos(datfcb,21))
         {prtstr("***Cannot Write .DAT***");
          crlf();pause();return;
         }
     datcnt=0;
    }

renames()
    {char *mem;
     int i;
     mem=tfcb;
     erase(tfcb,36);
     i=0;while(i<11)mem[i+1]=fcbbak[i++];
     bdos(mem,19); /* Delete old .BAK */
     erase(tfcb,36);
     i=0;while(i<11) /* rename .DIR to .BAK */
              {mem[i+1]=fcbdir[i];
               mem[i+17]=fcbbak[i++];
              }
     if((bdos(mem,23)&255)==255)
          prtstr("Cannot Backup Old [MASTER].DIR");
     erase(tfcb,36);
     i=0;while(i<11)mem[1+i]=fcbdir[i++];
     bdos(mem,19);
     erase(tfcb,36);
     i=0;while(i<11) /* rename .$$$ to .DIR */
         {mem[i+1]=fcbdol[i];
          mem[i+17]=fcbdir[i++];
         }
     if((bdos(mem,23)&255)==255)
          prtstr("Cannot Save New [MASTER].DIR");
     return;
    }
```

```
erase(ptr,n) char *ptr; int n;
    {int i; i=0;while(i<n)ptr[i++]=0;}

openmst()
    {volnent=0; erase(rfcb,36);
     i=0;while(i<11)rfcb[i+1]=fcbdir[i++];
     if((bdos(rfcb,15)&255)==255) /* try to open */
         {prtstr("No [MASTER].DIR present");
          if(option=='1')return (eof=1);
          prtstr(" - creating it"); crlf();
          if((bdos(rfcb,22)&255)==255) /* try to make */
              {prtstr("No room for [MASTER].DIR");
               bdos(0,0);
              }
         }
     eof=0;rcnt=8;
     setmask();
     getent();
     getvol();
    }


setmask()
    {int i,j,k,len;
     char buf[20],maskfile[20],maskext[20];
     if(option=='4')
         {i=0;while(i<14)pmask[i++]='?';
          return;
         }
     crlf();prtstr("Pattern to Match for ");
     if(option=='1')prtstr("List"); else prtstr("Extraction");
     prtstr("   vol:filename.ext");
     crlf();prtstr(" ? matches any character");
     crlf();prtstr(" * matches any subfield");
     crlf();prtstr(" omitted subfield assumes *");crlf();
     crlf();prtstr("Enter Pattern ");
     erase(buf,20);
     buf[0]=18;bdos(buf,10); /* read console buffer */
     len=buf[1];
     i=0;while(i<18)pmask[i]=maskfile[i]=maskext[i++]=' ';
     pmask[0]=maskfile[0]=maskext[0]='*';
     i=j=0;while((i<len)&(buf[2+i]!=':'))++i;
     if(buf[2+i]==':')
         {while(j<i)pmask[j]=buf[2+(j++)];
          j=++i;
         }
     i=0;while((i<len)&(buf[2+i]!='.'))++i;
     k=0;while(j<i)maskfile[k++]=buf[2+(j++)];
     if(buf[2+i]=='.')
         {j=++i;
          while(buf[2+i])++i;
          k=0;while(j<i)maskext[k++]=buf[2+(j++)];
         }
     expandast(pmask,3);
     expandast(maskfile,8);
     expandast(maskext,3);
     i=0;while(i<8)pmask[3+i]=maskfile[i++];
     i=0;while(i<3)pmask[11+i]=maskext[i++];
    }


expandast(ptr,len) char *ptr; int len;
    {int i;
     i=0;while(i<len)if(ptr[i++]=='*')
                {ptr[i-1]='?';
                 ptr[i]='*';
                }
     return;
    }

opennew()
    {int i;
     erase(nfcb,36);
     i=0;while(i<11)nfcb[i+1]=fcbdol[i++];
     bdos(nfcb,19); /* delete any old .$$$ */
     erase(nfcb,36);
     i=0;while(i<11)nfcb[i+1]=fcbdol[i++];
     if((bdos(nfcb,22)&255)==255) /* try to create .$$$ */
         {prtstr("No room for new file");
          crlf();
          bdos(0,0);
         }
     erase(nbuff,128);
     ncnt=0;
    }

closemst() {bdos(rfcb,16); /* close file */ }

closenew()
    {if(ncnt)wrtnew();
     if((bdos(nfcb,16)&255)==255)  /* close new file */
          prtstr("What happened to [MASTER].$$$");
     return;
    }

closedat()
    {if(datcnt)wrtdat();
     if((bdos(datfcb,16)&255)==255)  /* close .DAT file */
          prtstr("What happened to [MASTER].DAT");
     return;
    }

getvol()
    {int i,k;
     loadvol();
     if(option='4')
         {if(dcnt<=ndels)
              {if(!(k=match(dels+(dcnt*3),vol+16,0,2)))
                   {dcnt++;loadvol();}
               else if(k<0)dcnt++;
              }
         }
     return;
    }

loadvol()
    {int i;
     volnent=0;
     i=0;while(i<3)oldent[i]=newent[i++];
     while((!eof)&(!match(newent,oldent,0,2)))
         {k=(volnent+1)<<4;
          i=0;while(i<16)vol[k+i]=newent[i++];
          if(newent[0])++volnent;
          getent();
         }
    }

getent()
    {int i,j;
     while(1)
```

```
        {if(rcnt>7)readrec();
         j=(rcnt++)<<4;
         i=0;while(i<16)newent[i]=rdbuff[j+(i++)];
         if(!newent[0])
              {eof=1;return;}
           else
              if(!pmatch(newent,pmask,0,13))return;
        }
    }

 pmatch(a,b,m,n) char *a,*b; int m,n;
    {int i;
     if(eof)return 0;
     i=m;while(i<=n)
              {if(pmask[i]!='?')
               if(newent[i]!=pmask[i])return 1;
               ++i;
              }
     return 0;
    }

readrec()
    {int i; char *ptr;
     rcnt=0;ptr=tbuff;
     if(bdos(rfcb,20)&255)erase(rdbuff,128);
       else  {i=0;while(i<128)rdbuff[i]=ptr[i++];}
     return;
    }

/* compare string a to string b starting at char f ending at char l */
/* return 1 if a>b, -1 if a<b, or 0 if a=b */
match(a,b,f,l) char a[],b[]; int f,l;
    {int i;
     i=f;while(i<=l)
              {if(a[i]>b[i])return 1;
               if(a[i]<b[i])return -1;
               i++;
              }
     return 0;
    }

crlf() {outch(13); outch(10);}

prtstr(str) char *str; {int k;k=0;while(str[k])outch(str[k++]);}

todec(n,str) int n; char str[];
    {int i,k,zs; char c;
     i=zs=0;
     k=10000;
     if(n<0) {str[i++]='-';n=(-n);}
     while(k)
         {c=n/k + '0';
          if((c!='0')|(k==1)|(zs)){zs=1;str[i++]=c;}
            else if(k<=100)str[i++]=' ';
          n=n%k;
          k=k/10;
         }
     str[i]=0;
    }

prtdec(num) int num;
   {char str[7];
    todec(num,str);
    prtstr(str);
   }
```

Cryptograms

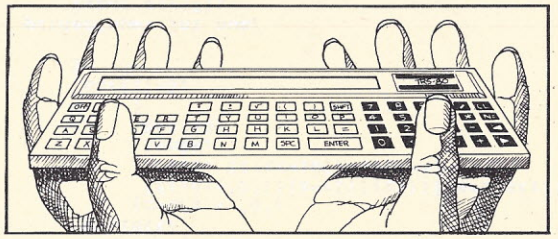
Continued from page 111

Program listing

```
10 CLS:CLEAR 1000:RANDOM
20 PRINTTAB(27);"CRYPTOGRAM":PRINTTAB(31);"BY":PRINTTAB(28);"DAN LOVY":PRINT
30 DEFINT A-Z:DIM A(26),A$(50)
40 FOR X=65 TO 90:A(X-64)=X:NEXT X
50 FOR X=1 TO 26:R=RND(26):SAV=A(X):A(X)=A(R):A(R)=SAV:NEXT
60 Z=Z+1:PRINTZ;" ";:GOSUB 1000
70 IF A$(Z)="*" THEN 90
80 GOTO 60
90 CLS:PRINT:Z1=Z:FOR Z=1 TO Z1-1:PRINTZ;" ";A$(Z):NEXT:PRINT
100 INPUT"DO YOU WANT TO REENTER A LINE";P$
110 IF LEFT$(P$,1)="Y" THEN INPUT"WHICH LINE";Z:PRINT Z;" ";:GOSUB 1000:Z=Z1:GO
TO 90
120 INPUT"READY PRINTER THEN PRESS <ENTER>";P$:LPRINT CHR$(30)
130 FOR Z=1 TO Z1-1
140 FOR X=1 TO LEN(A$(Z))
150 IF A$(Z)="" THEN 180 ELSE B=ASC(MID$(A$(Z),X,1))
160 IF B>64 AND B<91 THEN LPRINT CHR$(A(B-64)); ELSE LPRINT CHR$(B);
170 NEXT X
180 LPRINT " "CHR$(13)
190 NEXT Z:END
1000 CO=0:A$(Z)=""
1010 PO=256*(PEEK(16417)-60)+PEEK(16416)
1020 PRINT@ PO,CHR$(95);:FOR WAIT=1 TO 30:IN$=INKEY$:IF IN$<>"" THEN 1050
1030 NEXT
1040 FOR WAIT=1 TO 30:IN$=INKEY$:IF IN$="" THEN PRINT@ PO," ";:NEXT:GOTO 1020
1050 IF ASC(IN$)=13 THEN PRINT@ PO," ":RETURN
1060 IF ASC(IN$)<32 THEN POKE 15360+PO,32
1070 PRINT@ PO,IN$;:IF ASC(IN$)>95 THEN IN$=CHR$(ASC(IN$)-32)
1080 IF ASC(IN$)=8 THEN CO=CO-1:A$(Z)=LEFT$(A$(Z),CO):GOTO 1010
1090 CO=CO+1:IF CO=40 THEN PRINT@ PO," ":RETURN ELSE A$(Z)=A$(Z)+IN$:GOTO 1010
```

A Printer for the Handheld TRS-80

Continued from page 109



Listing. Shell-Metzner sort for the TRS-80 pocket computer.

```
10 "START" REM SORTROUTINE
20 D=26: N=0
30 "LOOP" INPUT ":";X: IF X<-20 GOTO "CON"
40 N=N+1: B=D+N: A(B)=X
50 GOTO "LOOP"
60 "CON" PRINT "ORIGINAL": GOSUB "PRN"
70 GOSUB "SOR"
80 PRINT "SORTED": GOSUB "PRN"
90 GOTO "START"
199 REM
200 "PRN" FOR Z=1 TO N: B=D+Z
210 PRINT USING "###";Z;USING "###.##";A(B)
220 NEXT Z: RETURN
299 REM
300 "SOR" REM SHELLSORT
301 REM BASIC PROGRAMS FOR SCIENTISTS AND
302 REM ENGINEERS, A. MILLER, SYBEX, 1981
303 H=N
304 H=INT (H/2): IF H=0 GOTO 318
306 K=N-H
307 FOR J=1 TO K: I=J
309 M=I+H: B=I+D: C=M+D
310 IF A(B) <= A(C) GOTO 316
312 F=A(B): A(B)=A(C): A(C)=F: I=I-H
315 IF I>0 GOTO 309
316 NEXT J
317 GOTO 304
318 RETURN
```

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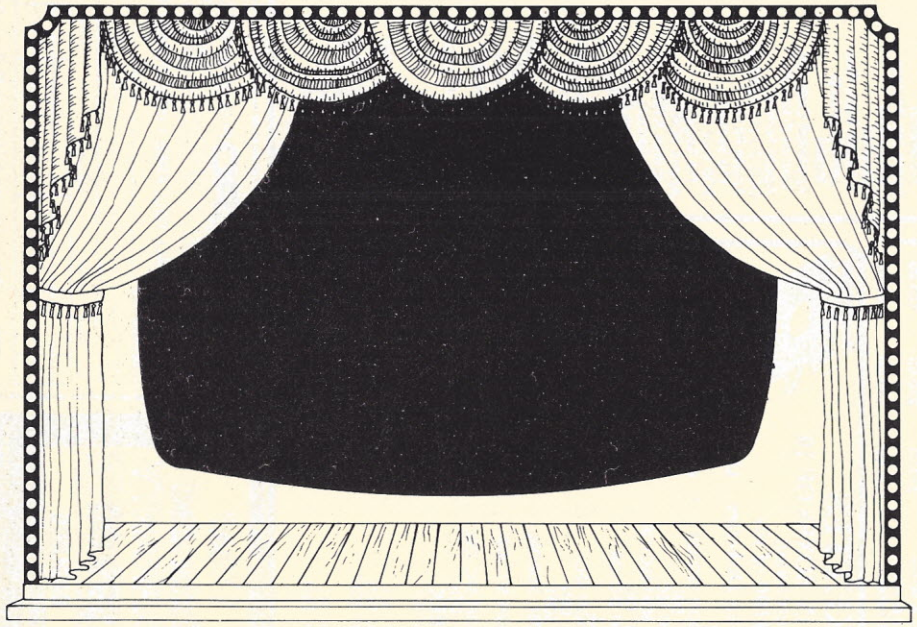

Listing

```
0100                    ORG     100H
                        ;
0016 =                  LMAX    EQU     22      ;MAX LINES/SCREEN
0005 =                  BDOS    EQU     5       ;DOS ENTRY POINT
0001 =                  CONS    EQU     1       ;READ CONSOLE
0002 =                  TYPEF   EQU     2       ;WRITE CONSOLE
0009 =                  PBUF    EQU     9       ;PRINT CONSOLE BUFFER
000B =                  BRKF    EQU     11      ;CONSOLE READY
000F =                  OPENF   EQU     15      ;FILE OPEN
0014 =                  READF   EQU     20      ;READ FUNCTION
                        ;
005C =                  FCB     EQU     5CH     ;FILE CONTROL BLOCK
0080 =                  BUFF    EQU     80H     ;DISK BUFFER ADDRESS
```

```
014E CD7201             CALL    READ    ;GET THE CHAR
0151 E67F               ANI     7FH
0153 FE20               CPI     ' '     ;BLANK?
0155 C26A01             JNZ     FINIS   ;ABORT
0158 AF                 XRA     A
0159 326302             STA     LCOUNT  ;RESET LINE COUNT
015C 3E0D               MVI     A,CR
015E CD9101             CALL    PCHAR   ;SEND CARRIAGE RETURN
0161 C31A01             JMP     GLOOP
                        ;
                        ; NO SUCH FILE, GIVE ERROR MESSAGE AND QUIT
                        ;
0164 11F501     NOFILE: LXI     D,OPNMSG
0167 CD9E01             CALL    PRINT
                        ;
                        ; DONE, RETURN TO CCP
                        ;
016A CD8A01     FINIS:  CALL    CRLF
016D 2A6602             LHLD    OLDSP   ;GET OLD STACK
0170 F9                 SPHL
0171 C9                 RET             ;TO THE CCP
                        ;
                        ; READ CONSOLE CHARACTER
                        ;
0172 E5         READ:   PUSH H          ;SAVE REGISTERS
0173 D5                 PUSH D
0174 C5                 PUSH B
0175 0E01               MVI     C,CONS  ;CONSOLE INPUT
0177 CD0500             CALL    BDOS
017A C1                 POP B           ;RESTORE
017B D1                 POP D
017C E1                 POP H
017D C9                 RET

                        ;
                        ; CHECK CONSOLE FOR KEY PRESSED
                        ;
017E E5         ABORT:  PUSH H          ;SAVE REGISTERS
017F D5                 PUSH D
0180 C5                 PUSH B
0181 0E0B               MVI     C,BRKF
0183 CD0500             CALL    BDOS
0186 C1                 POP B           ;RESTORE REGISTERS
0187 D1                 POP D
0188 E1                 POP H
0189 C9                 RET
                        ;
                        ; SEND CARRIAGE RETURN AND LINE FEED
                        ;
018A 3E0D       CRLF:   MVI     A,CR
018C CD9101             CALL    PCHAR
018F 3E0A               MVI     A,LF
                        ;
                        ; PRINT CHARACTER IN ACCUMULATOR
                        ;
0191 E5         PCHAR:  PUSH H          ;SAVE REGISTERS
```

```
                ;
000D =          CR      EQU     0DH     ;CARRIAGE RETURN
000A =          LF      EQU     0AH     ;LINE FEED
001A =          EOF     EQU     1AH     ;END OF FILE
                ;
                ; FILE-CONTROL BLOCK DEFINITIONS
                ;
005D =          FCBFN   EQU     FCB+1   ;FILE NAME
0065 =          FCBFT   EQU     FCB+9   ;FILE TYPE
007C =          FCBCR   EQU     FCB+32  ;NEXT RECORD
                ;
                ; SAVE OLD STACK, SET UP NEW ONE
                ;
0100 210000     START:  LXI     H,0
0103 39                 DAD     SP
0104 226602             SHLD    OLDSP   ;SAVE STACK
0107 318602             LXI     SP,STACK
010A CDC201             CALL    SETUP   ;SET UP INPUT FILE
010D FEFF               CPI     255
010F CA6401             JZ      NOFILE  ;FILE NOT PRESENT
0112 3E80               MVI     A,80H
0114 326402             STA     IBP     ;BUFFER POINTER END
0117 210000             LXI     H,0     ;START POINTER AT 0
                ;
011A E5         GLOOP:  PUSH    H       ;SAVE POINTER
011B CDA301             CALL    GNB
011E E1                 POP     H
011F DA6A01             JC      FINIS   ;END OF FILE
0122 47                 MOV     B,A
0123 FE1A               CPI     EOF     ;END?
0125 CA6A01             JZ      FINIS   ;YES
0128 CD9101             CALL    PCHAR   ;PRINT BYTE
012B 78                 MOV     A,B

012C E67F               ANI     7FH
012E FE0D               CPI     CR      ;END OF LINE?
0130 C21A01             JNZ     GLOOP   ;NO
                ;
                ; NEW LINE, INCREMENT COUNT
                ;
0133 3A6302             LDA     LCOUNT
0136 3C                 INR     A
0137 326302             STA     LCOUNT
013A FE16               CPI     LMAX    ;FULL PAGE?
013C C21A01             JNZ     GLOOP
                ;
                ; FREEZE SCREEN UNTIL SPACE BAR PRESSED
                ; OR ABORT IF OTHER KEY PRESSED
                ;
013F D5                 PUSH    D
0140 112A02             LXI     D,LMES  ;MESSAGE
0143 CD9E01             CALL    PRINT
0146 D1                 POP     D
0147 CD7E01     FREEZE: CALL    ABORT   ;CHECK CONSOLE
014A 0F                 RRC
014B D24701             JNC     FREEZE  ;LOOP UNTIL CHAR

0192 D5                 PUSH D
0193 C5                 PUSH B
0194 0E02               MVI     C,TYPEF
0196 5F                 MOV     E,A
0197 CD0500             CALL    BDOS
019A C1                 POP B           ;RESTORE REGISTERS
019B D1                 POP D
019C E1                 POP H
019D C9                 RET
                ;
                ; PRINT BUFFER UP TO $, POINTER IS DE
                ;
019E 0E09       PRINT:  MVI     C,PBUF
01A0 C30500             JMP     BDOS
                ;
                ; GET NEXT BYTE FROM DISK BUFFER
                ;
01A3 3A6402     GNB:    LDA     IBP
01A6 FE80               CPI     80H
01A8 C2B401             JNZ     GBYTE
                ;
                ; READ ANOTHER BUFFER
                ;
01AB CDE601             CALL    DISKR
01AE B7                 ORA     A       ;ZERO IF READ OK
01AF CAB401             JZ      GBYTE   ;FOR ANOTHER BYTE
01B2 37                 STC             ;END OF DATA
01B3 C9                 RET
                ;
                ; READ THE BYTE AT BUFF + ACCUMULATOR
                ;
01B4 5F         GBYTE:  MOV     E,A     ;PUT A IN DE
01B5 1600               MVI     D,0

01B7 3C                 INR     A       ;NEXT
01B8 326402             STA     IBP     ;SAVE ADDRESS
01BB 218000             LXI     H,BUFF
01BE 19                 DAD     D       ;ADD OFFSET
01BF 7E                 MOV     A,M     ;GET BYTE
01C0 B7                 ORA     A       ;RESET CARRY
01C1 C9                 RET
                ;
                ; SET UP FILE AND OPEN FOR INPUT
                ;
01C2 AF         SETUP:  XRA     A       ;ZERO ACCUMULATOR
01C3 327C00             STA     FCBCR   ;RESET RECORD
                ;
                ; CHECK FOR COM FILE
                ;
01C6 2A6500             LHLD    FCBFT   ;FILE TYPE
01C9 7D                 MOV     A,L     ;FIRST CHARACTER
01CA FE43               CPI     'C'
01CC C2DE01             JNZ     SET2    ;NOT COM
01CF 7C                 MOV     A,H     ;SECOND CHARACTER
01D0 FE4F               CPI     'O'
01D2 C2DE01             JNZ     SET2    ;NOT COM
```

```
                     ;
                     ; TELL ABOUT COM FILE AND THEN ABORT
                     ;
01D5 111202                LXI     D,CMES    ;ERROR MESSAGE
01D8 CD9E01                CALL    PRINT     ;SEND
01DB C36A01                JMP     FINIS
                     ;
01DE 115C00          SET2: LXI     D,FCB
01E1 0E0F                  MVI     C,OPENF
01E3 C30500                JMP     BDOS
                     ;
                     ; READ DISK FILE RECORD
                     ;
01E6 E5              DISKR: PUSH H           ;SAVE REGISTERS
01E7 D5                    PUSH D
01E8 C5                    PUSH B
01E9 115C00                LXI     D,FCB
01EC 0E14                  MVI     C,READF
01EE CD0500                CALL    BDOS
01F1 C1                    POP B             ;RESTORE REGISTERS
01F2 D1                    POP D
01F3 E1                    POP H
01F4 C9                    RET
                     ;
                     ; STORAGE AREA
                     ;
01F5 0D0A            OPNMSG: DB     CR,LF
01F7 4552524F52              DB     'ERROR--disk file not found$'
0212 0D0A43616ECMES:         DB     CR,LF,'Can''t print com files$'
022A 0D0A            LMES:   DB     CR,LF
022C 5072657373              DB     'Press space bar to continue,'
0248 206F722061              DB     ' or anything else to quit.$'
                     ;

0263 00              LCOUNT: DB     0        ;LINES PER SCREEN
0264                 IBP:    DS     2        ;INPUT BUFFER POINTER
0266                 OLDSP:  DS     2        ;INCOMING STACK POINTER
                     ;
0268                         DS     30       ;STACK SPACE
                     STACK:
0286                         END

Symbol Table

017E ABORT     0005 BDOS      000B BRKF      0080 BUFF
0212 CMES      0001 CONS      000D CR        018A CRLF
01E6 DISKR     001A EOF       005C FCB       007C FCBCR
005D FCBFN     0065 FCBFT     016A FINIS     0147 FREEZE
01B4 GBYTE     011A GLOOP     01A3 GNB       0264 IBP
0263 LCOUNT    000A LF        0016 LMAX      022A LMES
0164 NOFILE    0266 OLDSP     000F OPENF     01F5 OPNMSG
0009 PBUF      0191 PCHAR     019E PRINT     0014 READF
0172 READ      01DE SET2      01C2 SETUP     0286 STACK
0100 START     0002 TYPEF
```


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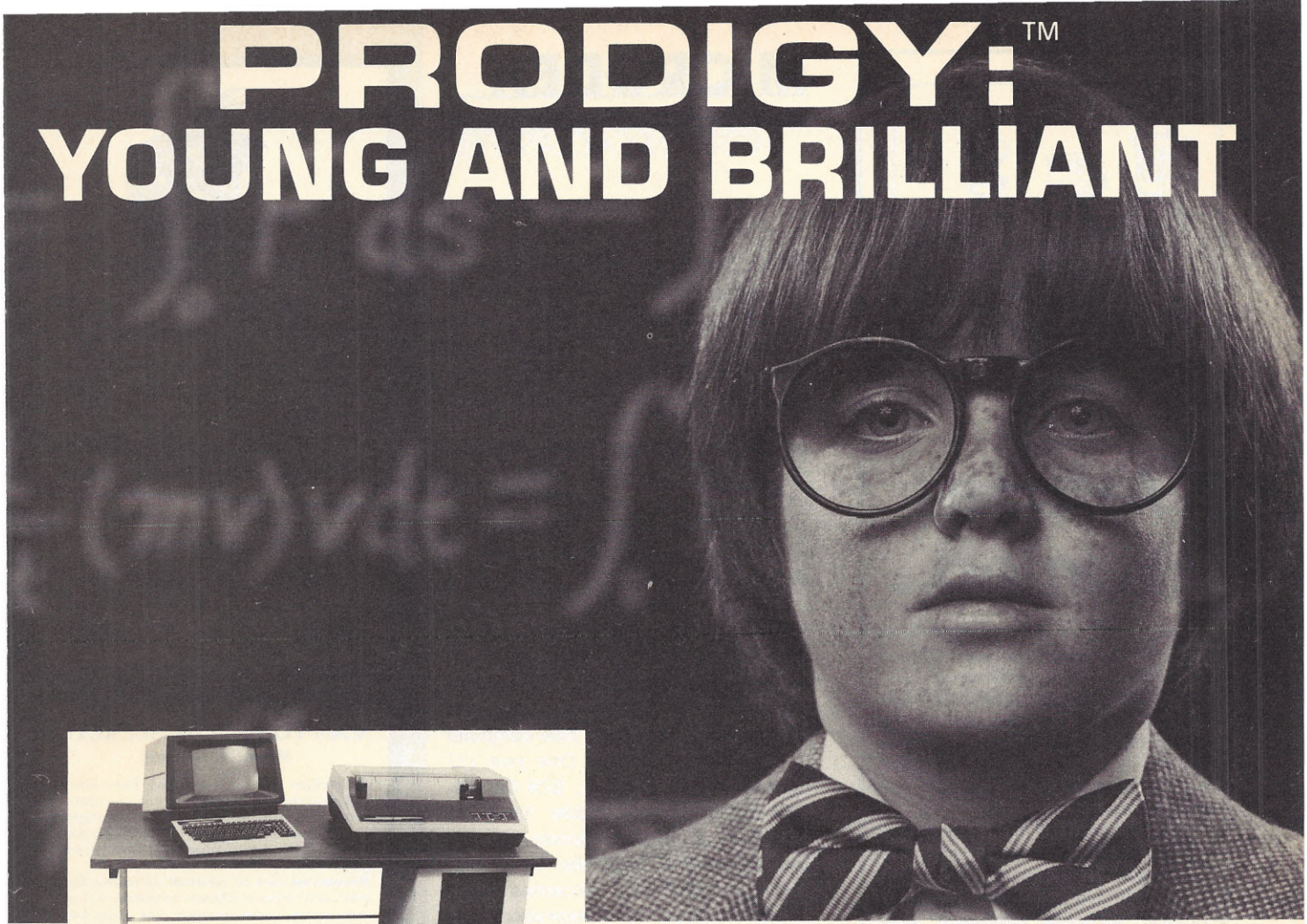

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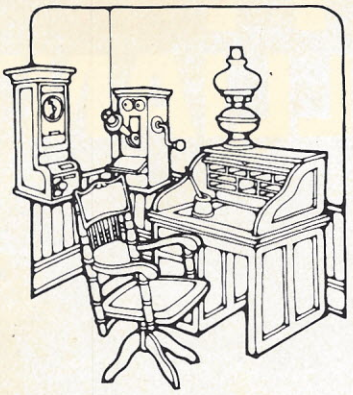

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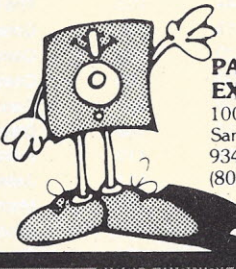

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